

Metal Finishing

POLISHING AND BUFFING • BARREL FINISHING • CLEANING
PLATING • ANODIZING • RUST PROOFING • LACQUERING & ENAMELING

JULY, 1959

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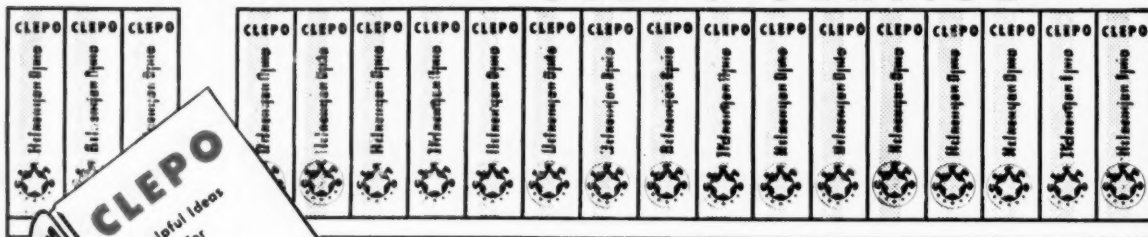
Science for Electroplaters

Copper Plating

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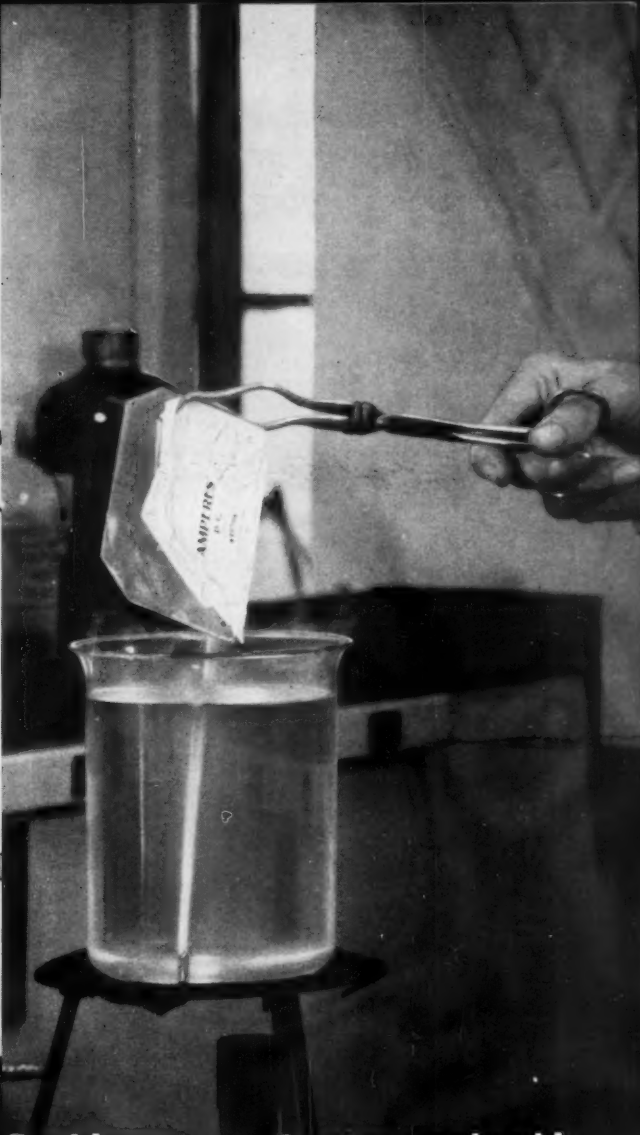
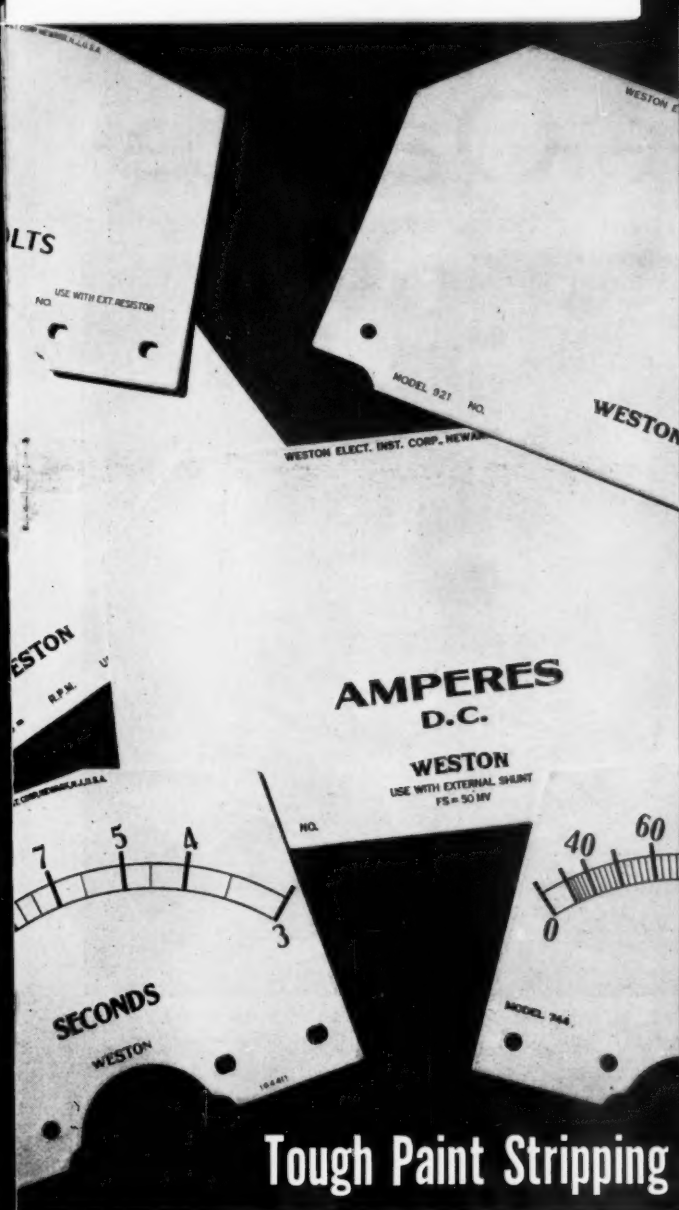
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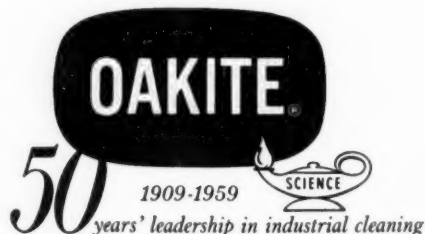
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61

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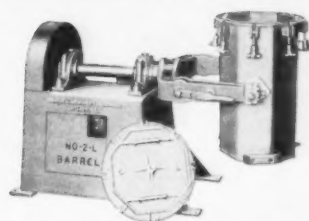
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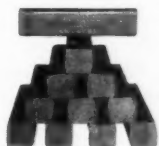
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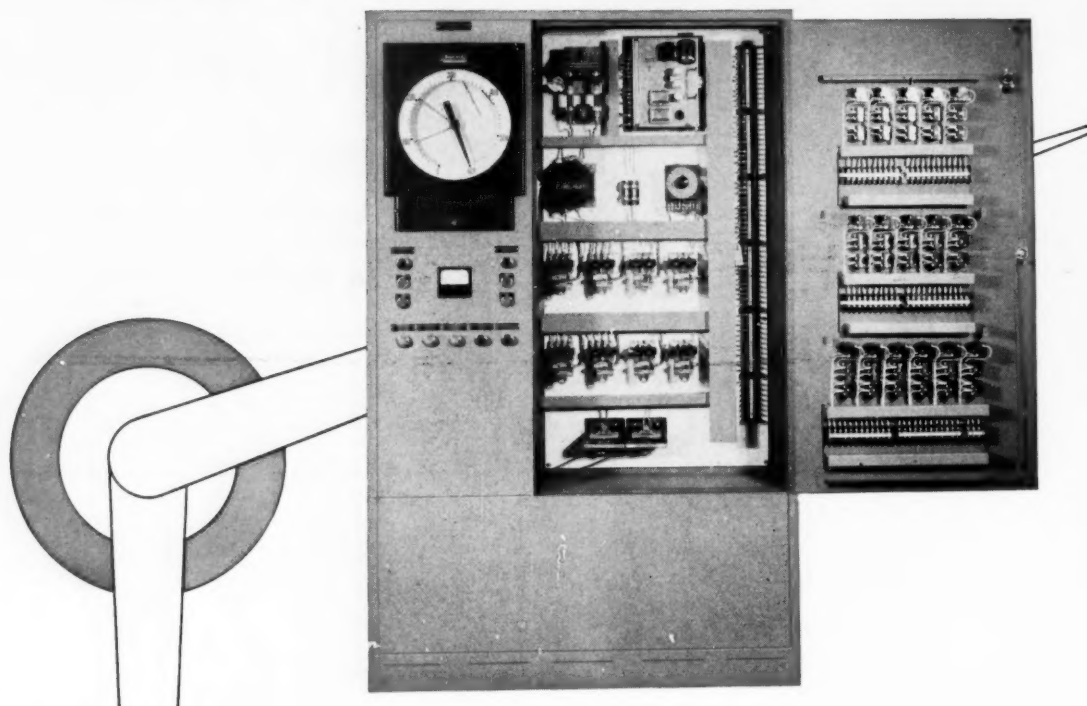
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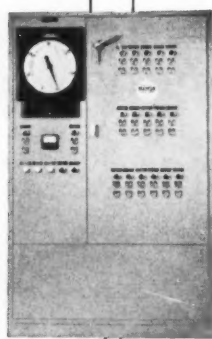
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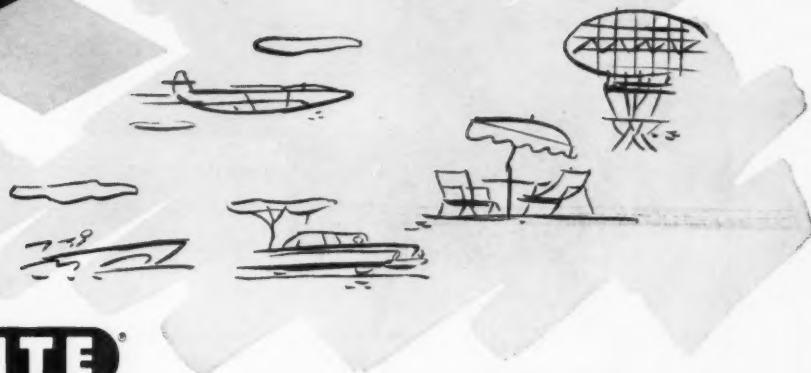
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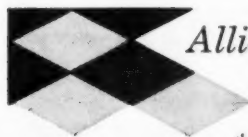
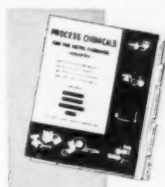
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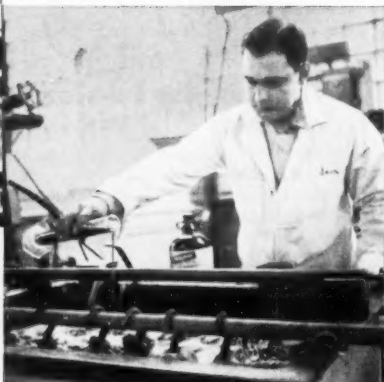
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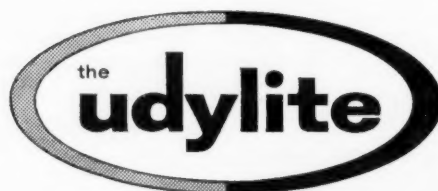


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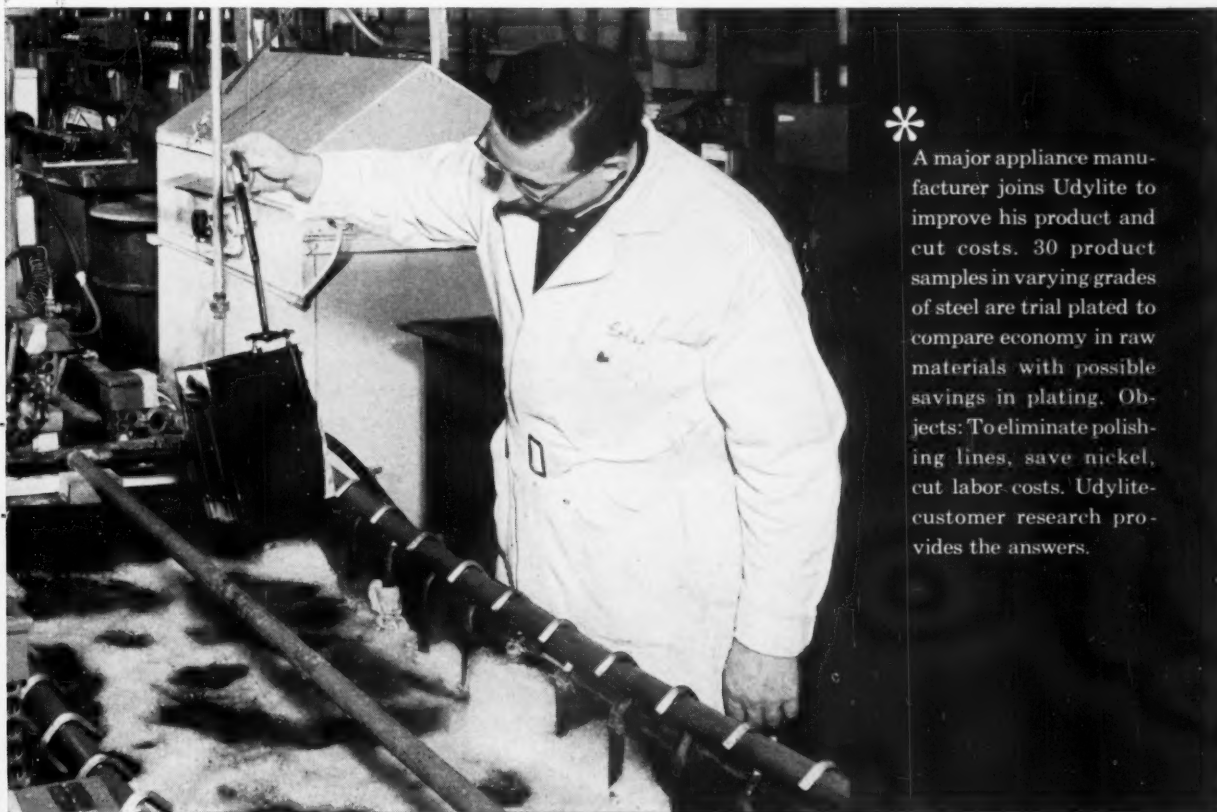


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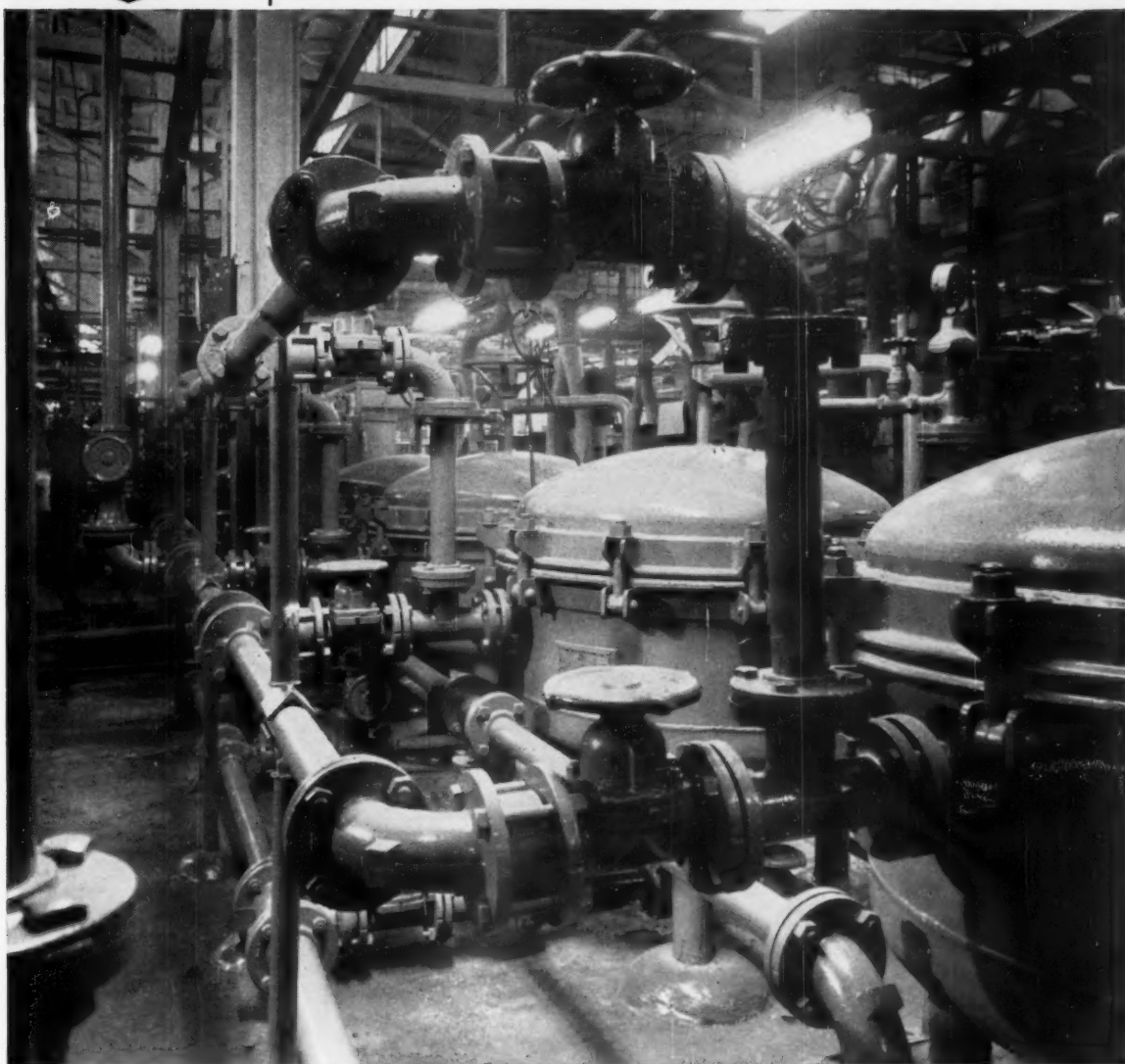
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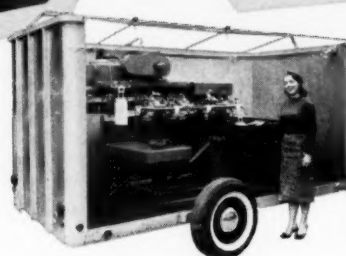
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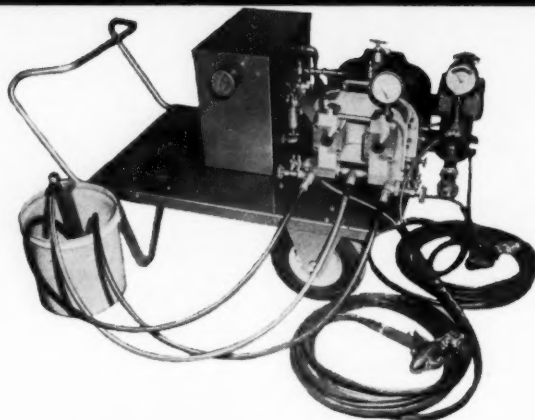


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METAL FINISHING, July, 1959

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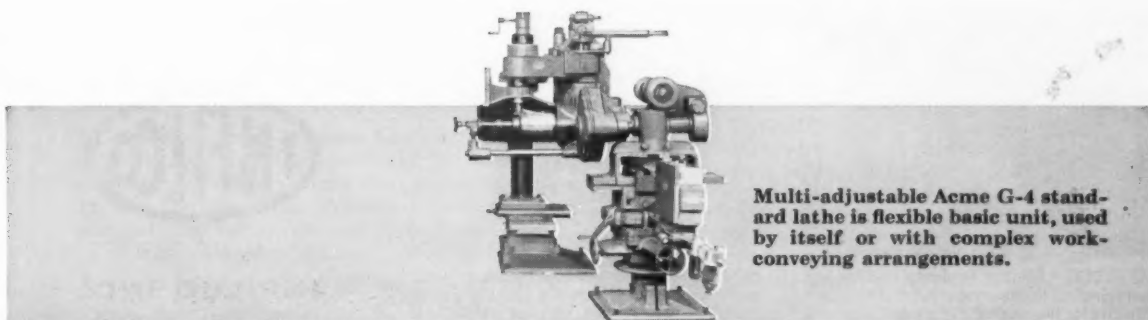
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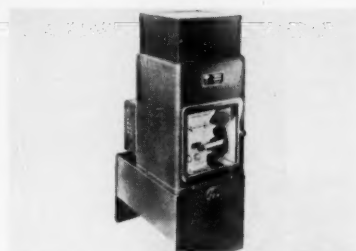


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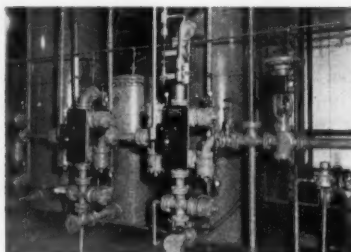
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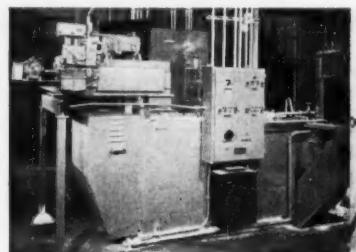
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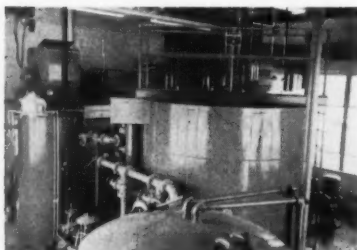
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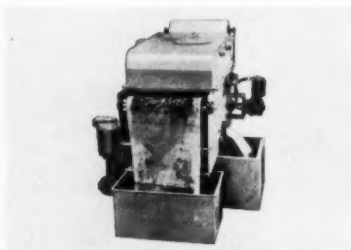
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Bulletin 9020-A



941

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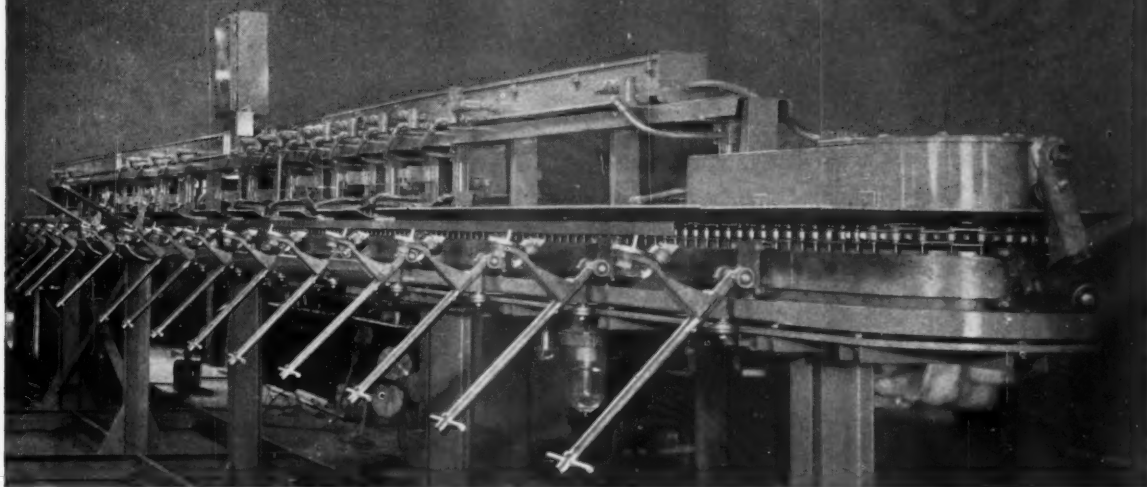
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MULTIPLE PROCESS PLATER

Another Lasalco development that offers the industry the last word in *fully automatic* plating!

With the new Select-O-Matic, the operator simply selects the desired process cycle for individual racks, when loading the machine, merely by turning a dial on the carrier. From that point, the rack *automatically* travels through the entire selected cycle without further attention.

A single Select-O-Matic plater, manned by one

operator, will handle several various processes simultaneously. Different machines for each process are eliminated—original investment in equipment is greatly reduced—much less floor space is needed—maintenance is cut to an absolute minimum.

The Select-O-Matic is easily adaptable to any operation. Tell Lasalco about *your* operation and requirements to learn what this new machine can do for *your* production and profits.

Write Today!

LASALCO, INC.

HOME OFFICE: 2820 LaSalle St. • St. Louis 4, Mo. • PRospect 1-2990
IN TEXAS: 2805 Allen Street • Dallas, Texas • RIverside 7-5814



metal cleaning report no. 2

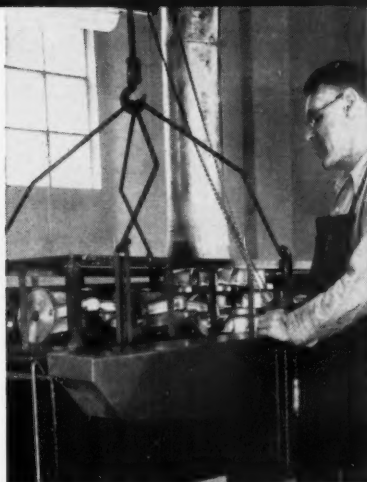
case histories from your Distributor of Dow Solvents



Flo-ball rocket valves are cleaned ultra-fine with Chlorothene. Fire hazards and toxicity problems are virtually nonexistent.

CHLOROTHENE MAKES ROCKET VALVES READY FOR ORBIT

Livingston, New Jersey—An Eastern concern in the business of manufacturing "flo-ball" valves for rockets was faced with a metal cleaning problem. They used an ultra-sonic bath to remove grease and other contaminants. Problem: Toxicity and fire hazard. Distributor's answer: Chlorothene[®] (Dow 1,1,1-trichloroethane, inhibited). Chlorothene did the ultra-fine cleaning job demanded. But, most important, the low toxicity rating of Chlorothene plus the fact that this versatile solvent has no fire or flash point solved the fire hazard and handling problems at the same time! Happy result: Renewed long term valve contract for the New Jersey firm.



DOW SOLVENTS MEN KNOW EQUIPMENT, TOO!

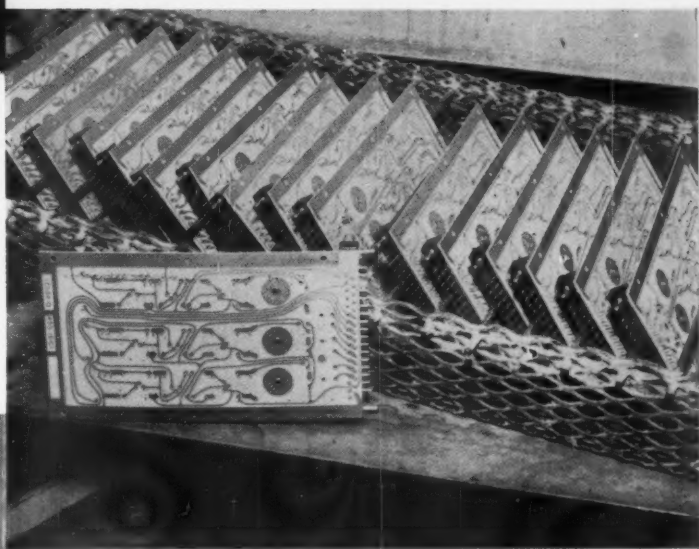
Paris, Illinois—An electric parts manufacturer had a problem: excessive vapors from his perchloroethylene degreasing operation. Result: solvent loss, worker discomfort, decreased production. A team from Dow and the distributor carefully studied the degreasing equipment. By changing adjustments on the machinery, the problem was solved. The condenser capacity was inadequate to condense and control the vapor. The point: Technical service men from Dow and its solvents distributors have cut their teeth on solvent and equipment problems. Their purpose in the field is to help customers. When their services are used properly, they save companies money!

COKING PROBLEM ELIMINATED

Machine company tried a number of brands of trichloroethylene to clean small machine parts made of brass, steel and aluminum. With each brand tried they experienced serious coking problems in their vapor degreaser. Periodically it had to be shut down for two or three days while the coal-like residue was chiseled out. The Dow solvents distributor in the area suggested NEU-TRI®, Dow's super-stable neutral type of trichloroethylene. NEU-TRI was tested for thirty days. At the end of that time, no coking deposits had appeared, and NEU-TRI has done the job ever since!

CIRCUITOUS ROUTE TO CLEAN CIRCUITS

St. Paul, Minnesota—Electronics manufacturer had to clean rosin flux from electric circuits. Trichloroethylene in this vapor degreasing operation was too slow and expensive. They had previously tried ultrasonics, but that process took the finish off the circuits. The fast, economic answer: Chlorothene, Dow's safer, more effective cold cleaning solvent. Chlorothene speeded production, did not injure the finish, reduced cleaning costs 16%! Now they complete the circuit on time!



Time and time again, Dow solvents distributors help manufacturers improve cleaning and stripping operations. And for two good reasons: (1) Dow offers the widest line of chlorinated solvents for modern industry; (2) Dow backs its distributors to the hilt with technical information and on-the-job help. Chances are good that one of the many Dow industrial solvents can help smooth out your operations, too. Dow solvents are made to high purity standards and each is designed to do a specific job and do it well. For help on your metal cleaning problems call on the nearby Dow solvents distributor.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN



FREE . . .
TECHNICAL SERVICE
on 24-hour notice

Your distributor of Dow solvents will gladly help you with any problems you are experiencing with metal cleaning solvents. He can have a trained solvents specialist en route to your plant within 24 hours after your call is received!

Ask your Dow solvents distributor for details.

CHLOROTHENE®
TRICHLOROETHYLENE
PERCHLOROETHYLENE
METHYLENE CHLORIDE

See Your Distributor of Dow Solvents First!

A Plating Solution Filter is known for the company it keeps



INDUSTRIAL TYPE 111 "workhorse" filter package system includes: filter, pumping unit, precoat slurry tank, primer-strainer tank and valve manifold to accommodate free pumping as well as filtration.

...and this one keeps company with those who demand lowest cost per gallon of filtrate.

This is the Type 111 Standard *Industrial* vertical leaf pressure filter. It is popular, preferred and keeps good plating company because it gives plating people what they want.

Its sound basic design is readily adaptable to literally hundreds of modifications—permitting compatibility of filter to system, high performance potential and lowest possible cost per gallon of filtrate. Type 111 is furnished with top outlet leaves and can be equipped for rapid air-wash cleaning. It can be used for any acid or alkaline plating solution, and is available in 25 standard sizes—ranging in flow capacities of 100 to over 30,000 gph. Smaller units are semi-portable. Larger units are stationary.

Bulletin 100EP gives full details on Type 111 and other *Industrial-Engineered* systems which have become *industry standards* because of their versatility and adaptability . . . for the filtering job at hand. Write for a copy.

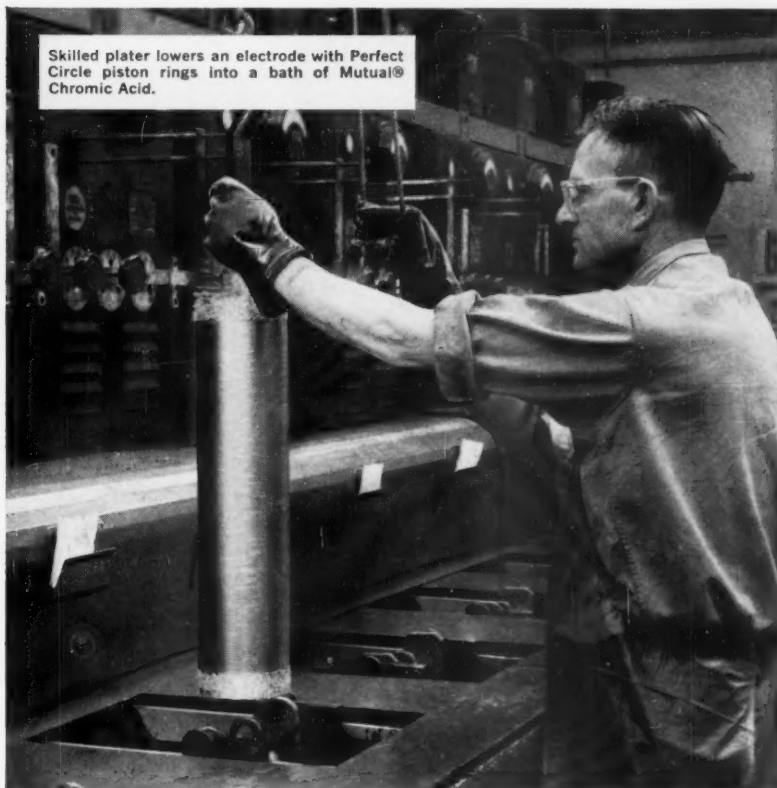


COVER REMOVED: Photo shows lock-up of two banks of seven leaves and interconnected double outlet with sight glasses.

INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. CO.
5906 Ogden Avenue, Cicero 50, Illinois

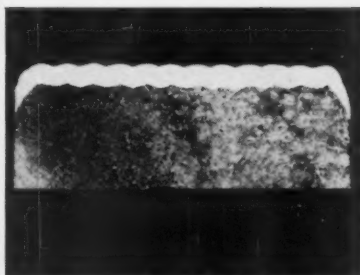
P359



Skilled plater lowers an electrode with Perfect Circle piston rings into a bath of Mutual® Chromic Acid.



Photo shows the Perfect Circle "200" chrome top compression ring (L) and "98" self expanding oil ring (R). The face of the compression ring and the steel rails of the oil ring are plated with solid chrome .004-.007" thick.



Sectional photomicrograph of the "200" compression ring shows interrupted surface and thick plating of chrome.

FOR PRECISION CHROME PLATING PERFECT CIRCLE USES MUTUAL CHROMIC ACID

Perfection is the goal in producing piston rings. Each is machine tooled to exacting specifications and the chrome plating must be flawless. To safeguard against plating difficulties . . . and expensive rejects . . . Perfect Circle Corporation relies on Mutual Chromic Acid. Like many experienced platers, Perfect Circle knows that careful control, plating skill plus Mutual Chromic Acid add up to a top quality chrome finish.

Mutual Chromic Acid is always 99.75% pure—or bet-

ter. Sulfate content never exceeds 0.1%. Rigid quality control by Mutual insures that the chromic acid you get is always the same. This makes it easier for you to control accurately the acid-sulfate ratio of your plating bath.

To obtain further information about these and other advantages of Mutual Chromic Acid, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service Staff will also be happy to offer help or information at any time.

OTHER PRODUCTS FOR PLATERS

SOLVAY® Ammonium Bicarbonate ■ SOLVAY Caustic Soda
SOLVAY Hydrogen Peroxide ■ SOLVAY Methylene Chloride



SOLVAY PROCESS DIVISION
61 Broadway, New York 6, N. Y.

MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast.

SOLVAY PROCESS DIVISION
ALLIED CHEMICAL CORPORATION
61 Broadway, New York 6, N. Y.

9-79

- ☐ Send Bulletin 52, "Chromium Chemicals"
☐ Have a representative phone for appointment

Name _____

Position _____

Company _____

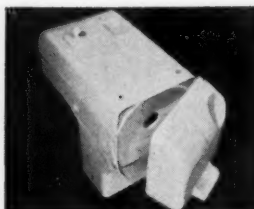
Phone _____

Address _____

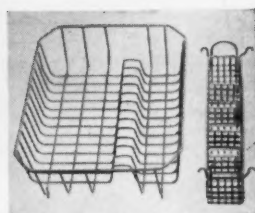
City _____ Zone _____ State _____

CORVEL[†]

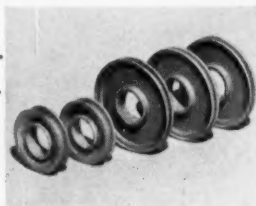
Fusion Bond Finishes—



CORVEL Cellulosic Finishes—tough decorative finish retains color and gloss when exposed to water, salt spray, sunlight.



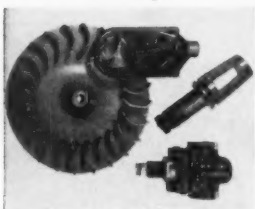
CORVEL Vinyl Finishes—durable; resistant to corrosion and most chemicals. Available in a range of colors.



CORVEL Nylon Finishes—to impart the outstanding wear and low frictional qualities of nylon to metals.

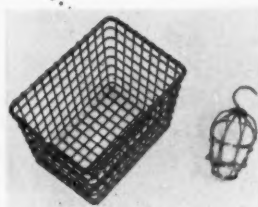


CORVEL Epoxy Finishes—excellent insulation at elevated temperatures; moisture, chemical and impact resistant.



CORVEL K-51 Penton[®] Finishes—exceptional chemical and wear resistance. Withstand temperatures from -40°F. to 250°F.

^{*}Trademark of Hercules Powder Co.



CORVEL Polyethylene Finishes—provide zero water absorption, excellent chemical resistance and electrical insulation.

Six new resins that broaden the possibilities of product finishing

• Now a unique method for cladding opens the way for new developments in product design. CORVEL Fusion Bond Finishes are specially processed dry resin powders for use in the solvent free, patented^{*} fluidized bed coating process. Greater beauty and improved durability are achieved because these finishes provide the following advantages:

- Single dip treatment with comparatively heavy finishes (normally 0.008" to 0.025").
- Eliminates sag and drips, no bridging or irregularities in material flow.
- Excellent coverage of sharp edges, corners and projections.

- Uniform, non-porous coatings having good adhesion provide excellent resistance to corrosion and mechanical abuse.

Process licensing is now readily available. A process license is automatically extended to the purchaser of CORVEL powders from National Polymer Products, Inc. upon payment of a small royalty added to each sales invoice. General licenses to use the patented process are available from Polymer Processes, Inc., an affiliate company.

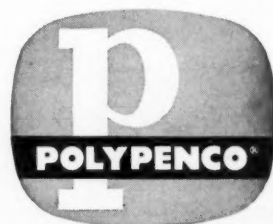
Technical service is available to help licensees achieve the greatest benefits from CORVEL resins and the fluidized bed process and equipment. Write for further details and the new full-color CORVEL bulletin.

NATIONAL POLYMER PRODUCTS, INC. / Reading, Pennsylvania

West Coast Facilities: The Polymer Corporation, Santa Ana, California

[†]Polymer Corporation trademark for finishing materials

^{*}U.S. Patent 2,844,489 and over 30 patents pending



The MURRAY-WAY JUNIOR FLAT POLISHER

*a versatile, high quality
unit with heavy-production
proven features.*

Available with conveyor,
pinch-roll or coil feed.
Wet or dry operation.

- Base holds cartridge filters and coolant reservoir.

- Saves belt cost. Uses belts from 6" to 12" width.

The Junior Flat Polisher is a compact, well built production unit for grinding, polishing or deburring flat surfaces in coils, sheets, blanks, bars, castings or fabricated parts at very low cost.

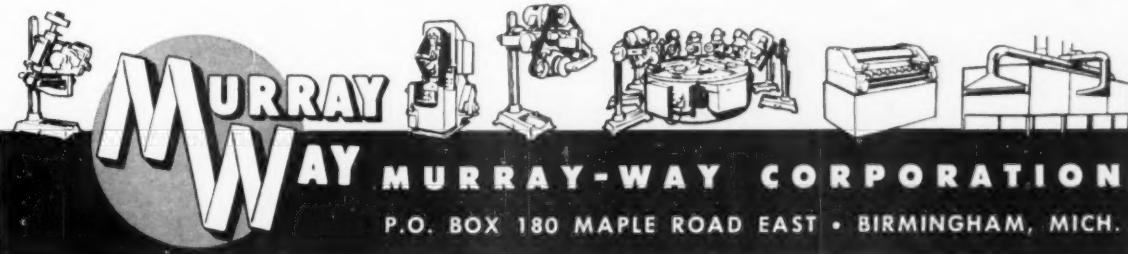
It is a standard size machine accepting work up to 12" wide, 4" thick and any length desired. Two or more units may be used in tandem to perform consecutive polishing operations.

Here is another of Murray-Way's well engi-

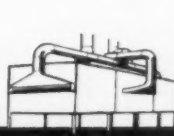
neered, standard line items which offer the reliability of Murray-Way's years of experience, proven features and fine quality work at surprisingly low cost.

Murray-Way has a complete line of automatic polishing, grinding, filtering, coating and materials handling equipment . . . standard or specially engineered.

- Adjustable, automatic oscillating idler roll for more uniform finish—longer belt life.
- Outside wheel adjusts for work thickness (0 to 4") in seconds. Entire belt roller and drive assembly mounted on one plate.
- Automatic, abrasive belt tension adjustment.
- Full length door makes belt changing easy, tension adjustment is automatic.
- Rigidly supported contact roll assures uniform work quality for full belt width.
- Neoprene contact roll is redressed on machine without special grinding attachments.
- Outside Ammeter indicates work pressure.



MURRAY WAY



MURRAY-WAY CORPORATION

P.O. BOX 180 MAPLE ROAD EAST • BIRMINGHAM, MICH.



Imperial's Plant Superintendent, left, and Wyandotte Representative Emil Haas examine frames cleaned with BUFSOL.

MARIANO RANNO



"Bufsol removes hard, tenacious buffing compound"

— says Mariano Ranno, secretary-treasurer, Imperial Plating Co., Brooklyn, N.Y.

"Wyandotte BUFSOL has proved itself a real performer in our plant," states Mr. Ranno.

"We use it to remove a hard, tenacious buffing compound from polished-steel hand-bag frames — items we plate in large volume. These frames must meet exacting quality standards for jewelry-type nickel and brass plating.

"BUFSOL has reduced our over-all cleaning costs, thanks to its effectiveness under difficult conditions. And the Wyandotte representative has worked closely with us to help effect these savings."

* * *

All-soluble Wyandotte BUFSOL removes buffing

compound *without solvents*. It's fast, safe, effective, and adaptable to every plating cycle.

BUFSOL liquid detergent concentrate assures bright, stain-free, adherent electrodeposits. And BUFSOL is safe on all metals, essentially odorless and will not contaminate your plating bath.

For full information and a demonstration of BUFSOL and other Wyandotte metal-cleaning products, call your Wyandotte representative today! Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California, and Atlanta, Georgia. Offices in principal cities.



Wyandotte CHEMICALS

J. B. FORD DIVISION

THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING

FOR THE FIRST TIME

A Completely Corrosion Resistant Heat Exchanger

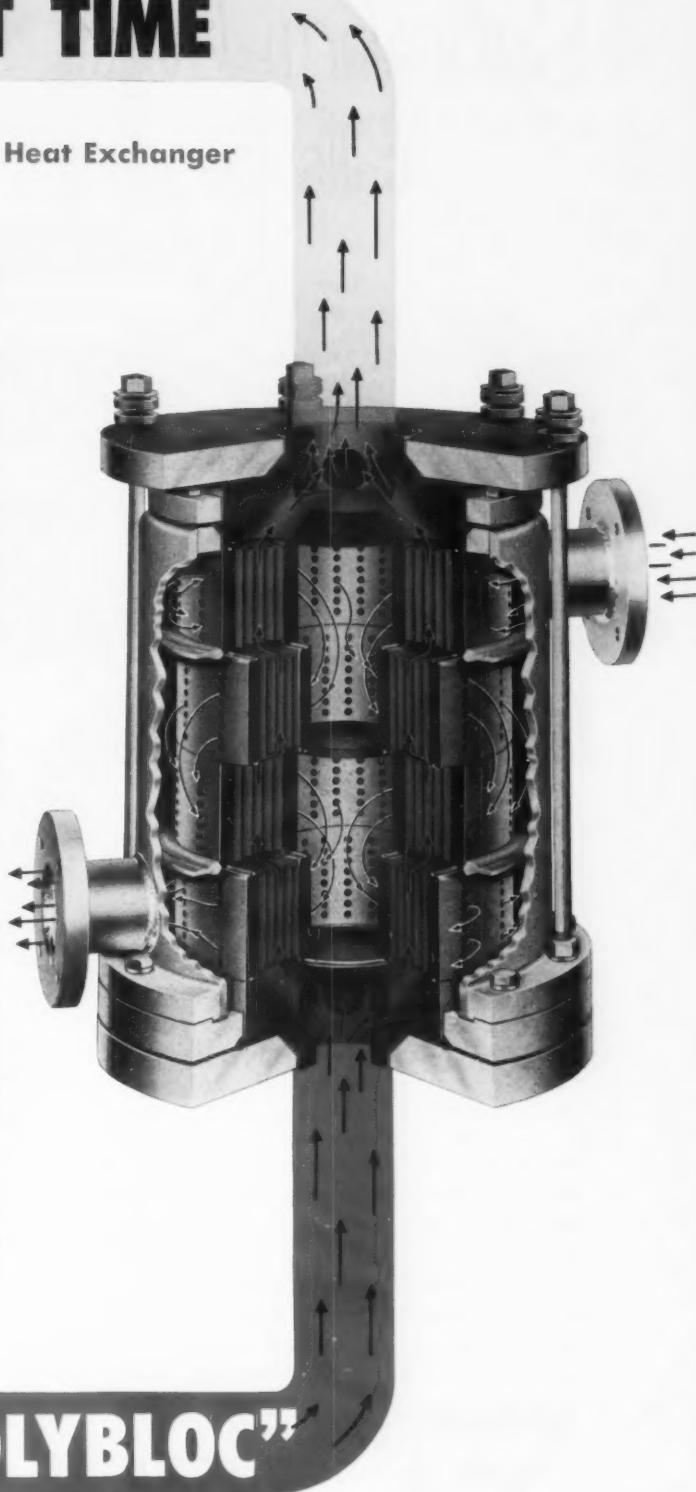
"POLYBLOC's" molded impervious graphite exhibits a thermal conductivity almost equal to that of copper, and very superior to that of stainless steel and extruded graphite. This sectional view of the CARBONE "POLYBLOC" heat exchanger demonstrates how the Carbone design produces maximum process heating or cooling efficiency under severe corrosive conditions.

Corrosive fluid flows through the axial passages and turbulence chambers in the graphite, and does not touch the outer metal housing, while the non-corrosive steam or water is directed through the adjacent radial passages in the blocks. Heat is transferred in the graphite itself.

Rugged one piece blocks held in compression against Teflon gaskets effect the best possible sealing. No fragile tubes to break. No cemented joints to leak.

Using a continuous high-turbulence passage design in a double-counterflow system, the CARBONE "POLYBLOC" heat exchanger maintains great efficiency even at very low velocities, and resists the formation of scale and film deposits. Modular construction simplifies addition or interchanging of blocks, speeding adaption, maintenance, and lowering costs. For heat transfer between two corrosive fluids, the "POLYBLOC" outer shell is also available in alloys or lined with suitable corrosion-resistant materials.

Investigate the CARBONE "POLYBLOC" heat exchanger. See how it can increase your process efficiency at lower overall cost. Write for full information.



CARBONE "POLYBLOC"



THE CARBONE CORPORATION • BOONTON, N. J.

Suburban living calls for versatile home fencing



like long lasting G & B
Welded-Fence, finished
with AHCO Compounds.

Around the yard or around the garden there's sure to be a job for G & B Welded-Fence or Flower Border. And this sturdy, attractive fencing costs less than the cheapest ornamental fence. No wonder sales to homeowners everywhere are mounting fast. To achieve longer fence life, to save time and labor, Gilbert & Bennett Manufacturing specifies Ahcoloid Metal Cleaners formulated especially for their finishing cycle.

Whatever you make, chances are good that you, too, can profit from the performance of one or more AHCO *custom* Compounds. We will be happy to show you how. Just write Apothecaries Hall Division, 28 Benedict St., Waterbury, Conn.



THE
HUBBARD-HALL CHEMICAL
COMPANY

APOTHECARIES HALL DIVISION

NEROFIL

*The ONLY all purpose
filter powder with these
characteristics:*

MINIMUM SOLUBILITY:

Most effective filteraid available for copper and all other cyanide type solutions. Being carbonaceous, NEROFIL is insoluble in the most difficult solutions; thus it eliminates plating solution roughness.

ALL PURPOSE FILTERAID:

NEROFIL is compatible with all plating solutions, eliminating the need for having one filteraid for alkaline and another for acid.

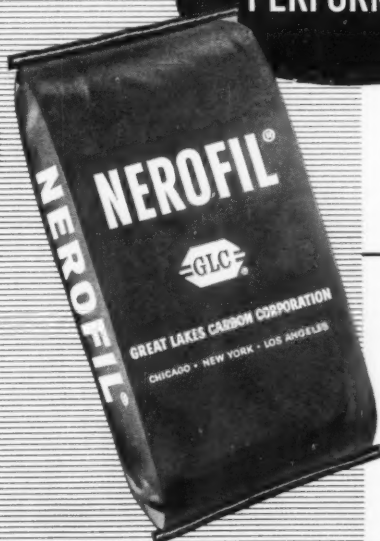
ECONOMY:

About one third less the amount of NEROFIL is commonly used for filter cake build-up due to its low density. Pound for pound, NEROFIL is normally less expensive than competitive products, which means double economy.

PERFORMANCE:

NEROFIL insures top clarity, flowrates and is less compressible, providing for longer filtration cycles.

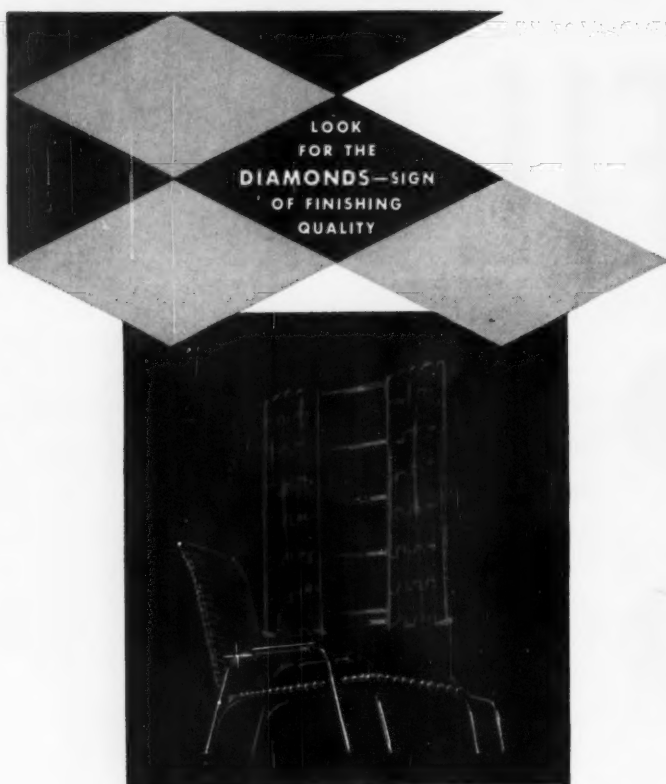
The NEROFIL BULLETIN provides more complete information. Just fill out the coupon for your copy.



NERO-PRODUCTS DEPT., Great Lakes Carbon Corp.
333 No. Michigan Ave. Chicago 1, Ill.

Please send me further information on Nerofil

NAME _____
POSITION _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____



**NOW—A Great New
Combination for
DOUBLE
PROTECTION
Against
Corrosive Conditions
on Aluminum,
Magnesium or Zinc**

IRIDITE[®]
CHROMATE CONVERSION COATINGS
and
IRILAC[™]
CLEAR PROTECTIVE COATINGS

Now, here's a fast, easy, economical way to almost double the protection against corrosion on your product. Simply follow up the IRIDITE process with a fast, easy application of IRILAC . . . and you've given your product extra protection for longer resistance to corrosive conditions, longer shelf or storage life protection from handling, and increased beauty for more attractive appearance and faster sales.

ON ALUMINUM

An IRIDITE-IRILAC finish will provide longer life for storm doors, windows, outdoor furniture, auto parts and accessories, tubing or wire goods. And, you have a choice of color finishes such as natural aluminum and golden yellow. Other colors may be obtained by an additional dye operation.

ON MAGNESIUM

IRILAC over an IRIDITE No. 15 finish increases corrosion protection, and provides resistance to finger printing and abrasion on all types of products, with color appearance ranging from light to dark brown.

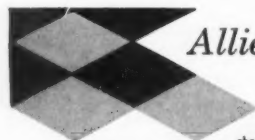
ON ZINC

IRIDITE plus IRILAC gives your product longer life and brighter appearance. Color choices range from clear IRIDITE to olive drab, plus colored dye finishes.

IRIDITE is the tradename for a specialized line of chromate conversion coatings that can be applied to any non-ferrous metal by brush, dip or spray methods—at room temperatures—manually or with automatic equipment. Upon application, a thin film forms which becomes an integral part of the metal itself, and thus cannot chip, flake or peel. No special equipment, exhaust systems or specially trained personnel are required.

IRILAC is the tradename for a line of clear protective coatings for all metals. As safe and easy to handle as water, they may be applied by brush, dip or spray methods. No exhaust or special fire protection equipment required. Adds protection and abrasion resistance to any base metal, plated part or parts treated with electrolytic or chemical post treatments, without chemical change.

For complete technical information on IRIDITE Chromate Conversion Coatings or IRILAC Clear Protective Coatings, write for **FREE TECHNICAL MANUAL**. Or, see the Allied Field Engineer in your area. He's listed under "Plating Supplies" in the yellow pages.



Allied Research Products, Inc.

Chemical and Electro-
chemical Processes, Anodes,
Rectifiers Equipment, and Supplies for Metal Finishing

IRIDITE[®]
Chromate
Coatings

IRILAC[™]
Clear
Coatings

ISOBRITE[®]
Plating
Brighteners

ARP[®]
Chemicals &
Supplies

WAGNER
Line of
Equipment

4004-06 EAST MONUMENT STREET • BALTIMORE 5, MARYLAND
BRANCH PLANT: 400 MIDLAND AVENUE • DETROIT 3, MICHIGAN
West Coast Licensee for Process Chemicals: L. H. Butcher Co.

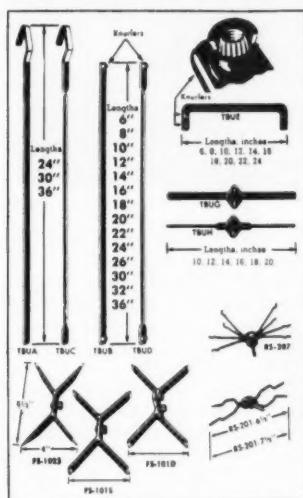
Thinker Boy Racks are an
Investment
 or
 other racks are just an
Expense?



Here are photographs taken in a large job plating plant that illustrate the tremendous expense caused by obsolescence and deterioration in storage of ordinary plating racks.

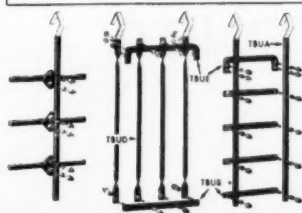
THINKER BOY PLATING RACKS eliminate a large share of this expense. They are assembled of standard pre-formed and pre-coated Thinker Boy sections that screw together with leakproof seals. Racks that are no longer needed can be dis-assembled and the Thinker Boy Rack Sections can be re-used in the assembly of racks to meet new requirements.

Re-usable Thinker Boy Rack Sections replace the loss and expense shown in the above picture with economy and profit.



How you can spend money and have it too!

GET THE FACTS! Send for 16-page Thinker Boy brochure that shows how to assemble, dis-assemble and re-assemble modern insulated plating racks — also illustrates Thinker Boy Removable Tips for racking articles of all shapes and sizes. This booklet has opened the way to tremendous savings in hundreds of plating plants.



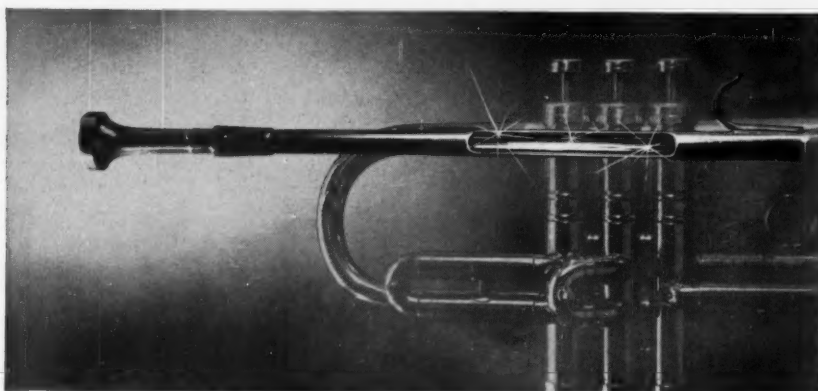
Belke

MANUFACTURING COMPANY
947 N. Cicero, Chicago 51

EVERYTHING FOR PLATING PLANTS



Conn produces the "heart" of good tone quality by electrodeposition, with "Plus-4" Copper Anodes



CONN ELECTRO-D TONE CHAMBER (mouthpipe) cut away to illustrate the "micro finish" interior surface. Chamber and mouthpiece receptacle are formed in one piece by electrodeposition; previously the two pieces were soldered together. (Patent pending.)

ELECTRO-D BELL, also formed by electrodeposition.



In a cornet or trumpet, good tone and easy playing depend largely on the inside shape and finish of the tone chamber (mouthpipe).

Aiming at perfection, C. G. Conn, Ltd., famous maker of band instruments, turned to forming these critical parts by electrodeposition of copper on stainless-steel mandrels. The deposited copper conforms perfectly to the precision mandrel—providing the exact taper and dimensions every time. It also gives the smooth mirrorlike inside surface that prevents acoustical losses. Even minor irregularities caused by forming sheet metal or tube can muffle, distort, or rattle the tone.

Using "Plus-4" Phosphorized Copper Anodes in its acid-copper electroplating tanks, Conn has found it gets the smooth, dense deposit it needs. The build-up of metal is fast and uniform, as "Plus-4" Anodes' extra "throwing power" is of particular value with the tubular shapes. There

are few nodules, which minimizes finishing of the outside surface. And tank maintenance is simplified.

Conn also forms the bells used in cornets, trumpets, and trombones electrolytically. This gives still further control in the precision of the entire inside tone columns of its instruments—for increased resonance and live, powerful tone.

WRITE FOR INFORMATION on how you can obtain a test quantity of "Plus-4" Anodes to supply one tank. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Toronto 14, Ontario.

59108

ANACONDA®

"PLUS-4" ANODES Phosphorized Copper
Made by The American Brass Company

METAL FINISHING, July, 1959

**EVERY \$6,400
YOU SAVE IN
DEGREASING COSTS
IS WORTH A
\$100,000 ORDER!**

Columbia-Southern TRICHLOR helps you save money

Pretax earnings average 6.4% or \$6,400 on each \$100,000 of product you sell after raw materials, sales expenses, overhead, and miscellaneous are deducted.* Every time you save \$6,400 in your degreasing costs, it is the equivalent of your net on a \$100,000 order.

Columbia-Southern is a foremost name in degreasing knowledge and experience, product quality, cost-saving operation. Our Technical Service specialists will be glad to examine your degreasing process and recommend ways in which you can effect savings.

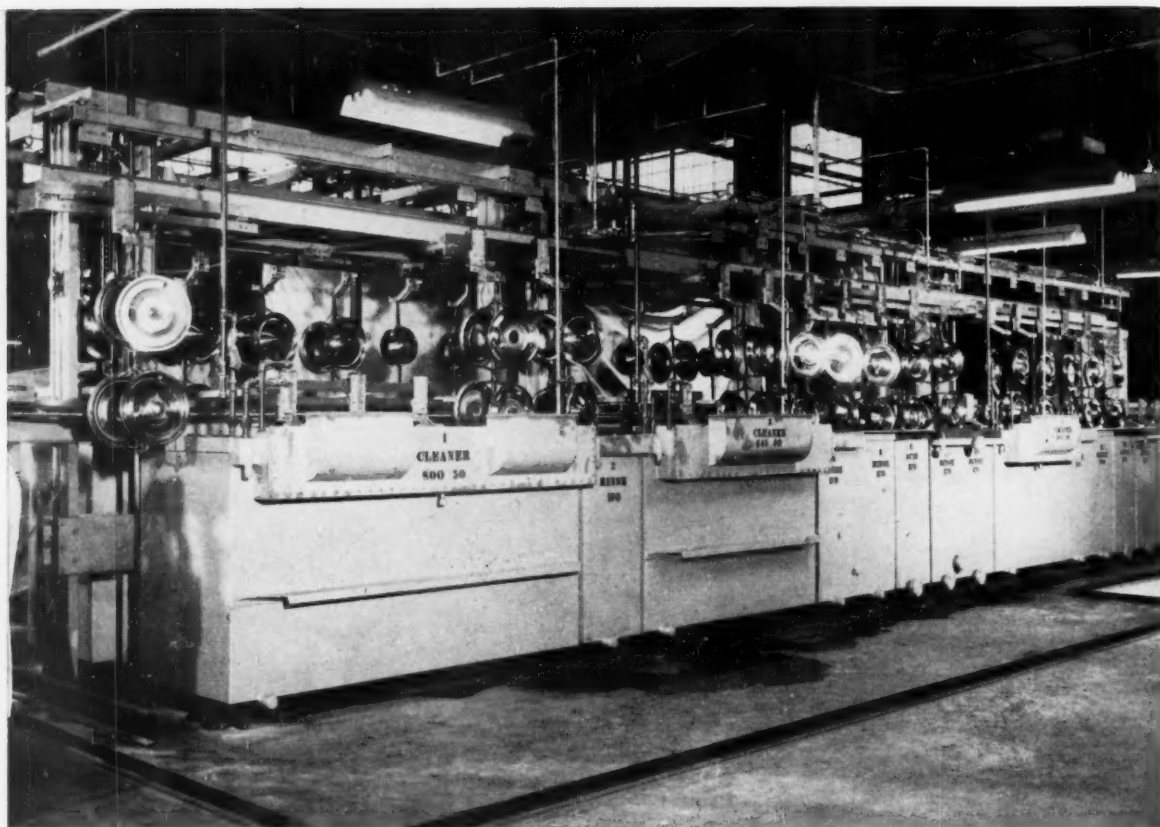
If a Columbia-Southern representative has not yet reviewed your degreasing operation, his visit will more than likely save you money. So, why wait? Write today to "Trichlor" at our Pittsburgh address.

*Based on Manufacturing Corporation Statistics for the first half of 1958.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

A Subsidiary of Pittsburgh Plate Glass Company • One Gateway Center, Pittsburgh 22, Pa.



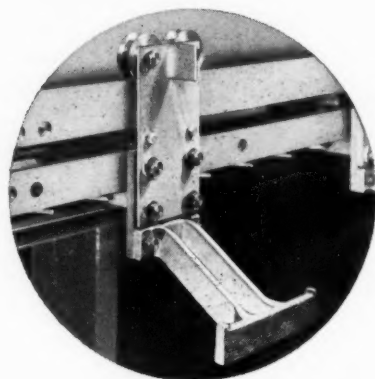


New Meaker Uniline machine provides high quality plating at high speeds

This Meaker Uniline Plating Machine was built to meet the rigid requirements of Namsco, Inc. in Bellwood, Illinois. It provides them with a continuous **uninterrupted high speed operation** that produces extremely high quality plating of replacement hub caps and wheel covers. This Meaker single row machine has a production capacity of **120 racks per hour** and handles the complete operation from cleaning to Nickel and Chrome plating.

Effective vertical length of rack is 34", width in direction of travel is 15" and tank widths are 16".

For your plating or anodizing equipment, look to Meaker . . . the name backed by a reputation for building the best for 50 years.



Electrical contacts on carriers are positive in action due to constant load pressure and the current path from cathode rail to rack is short, minimizing voltage loss.

Write for New Bulletin U-658



THE MEAKER COMPANY
1633 SOUTH 55TH AVE., CHICAGO 50, ILL.

HARSHAW NICKEL SULFATE CARRIES GUARANTEED SPECIFICATIONS



Harshaw, the world's foremost producer of high purity nickel sulfate, guarantees specifications from which you derive the following benefits:

1. Consistently high quality material, laboratory tested for use in dull, semi-bright, and bright nickel plating solutions.
2. Product uniformity from shipment to shipment on which you can depend.
3. Harshaw nickel sulfate is high in purity and contaminants will always be well below tolerable limits in your plating bath.

Additional bonus features of Harshaw Nickel Sulfate are . . . Free-flowing, small definite crystals of uniform size . . . Rapid, complete solubility.

We shall be happy to quote prices and provide detailed information upon receipt of your inquiry.

NICKEL SULFATE

GUARANTEED SPECIFICATIONS

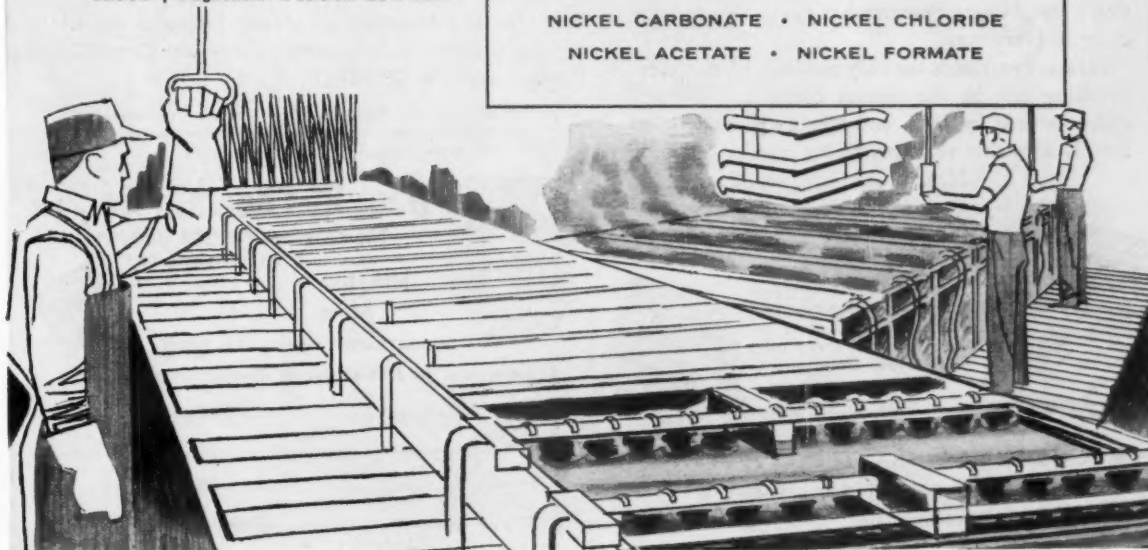
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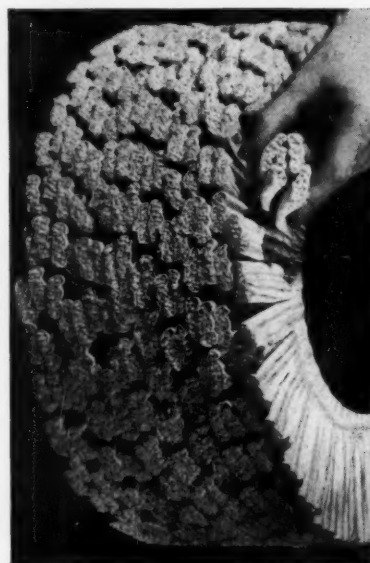
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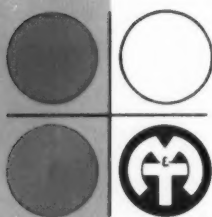



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Most widely known for smooth and exceptionally dense deposits, this process proves especially useful in engineering-type plating applications, such as on printed circuits, computers, and electroforming; also for impervious masking or stop-off in nitriding and carburizing applications.

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This practical and easy-to-control process deposits an alloy plate, usually 88% copper and 12% tin. Resembling 24K gold in color, M&T Bronze offers an unusually attractive final finish. As an undercoat, it surpasses copper on corrosion resistance. It also plates much faster with exceptional throwing power.

TIN AND TIN ALLOY PROCESSES

M&T High Speed Tin

The M&T High Speed Potassium Stannate Process is suited to a wide variety of still and automatic work, and especially to barrel plating. This High Speed Bath is preferred over sodium baths for many applications. It permits higher current densities with high cathode efficiency maintained. Solubility of the salts is better, and the solution is more stable and has higher conductivity.



M&T Sodium Stannate Tin Plating

This process, too, gives the advantages of an alkaline bath, such as simplicity of makeup and control, suitability of plain steel equipment, wide operating range and excellent throwing power.

Immersion Tinning

M&T Potassium Stannate serves for immersion tinning of bronze, copper and brass. Other M&T chemicals, including Stannoehlor® (anhydrous stannous chloride), are available for immersion plating of copper, steel and aluminum.

M&T Tin Zinc

Permits production of deposits of various ratios, with 78% tin and 22% zinc generally being the most useful; assures excellent corrosion resistance plus easy solderability for electrical products.

M&T Tin Nickel

This process deposits alloy of 65% tin, 35% nickel. Plate is attractive in appearance, highly resistant to corrosion, highly resistant to tarnishing. It can be deposited directly on most basis metals, by still tank, automatic or barrel plating methods.

CHROMATE TREATING

Unichrome Dips

M&T has developed one of the widest lines of these chromate conversion coatings available for zinc and cadmium. It includes materials for chemically producing chromium-like clears, yellow, brass, olive and black colors, as well as a new group of red, blue, green and gold dyed finishes. Unichrome Dip Finishes offer good resistance to salt spray and exposure tests, meeting Government and other specifications. They give eye appeal and corrosion protection at low cost.

Anozinc®

This exclusive M&T process converts zinc plate by anodic treatment. It produces black, clear or yellow chromate conversion coatings. Finishes are tougher than those produced chemically, and can be handled while wet. The Anozinc cycle uses conventional equipment. The solution has unusually long life and low cost operation.

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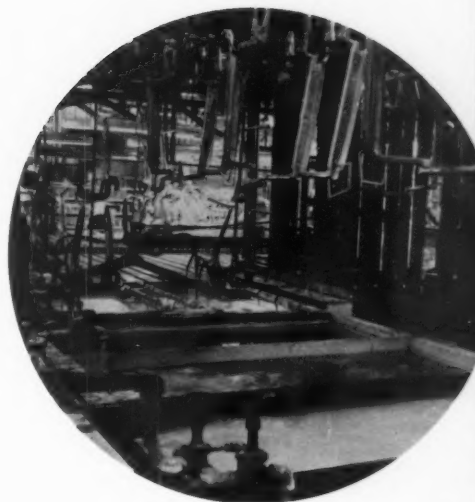
Platers have been saving maintenance money for a decade with this top quality rack coating. It has a built-in cure indicator, is approved for the most sensitive baths, can be rebaked for patching.

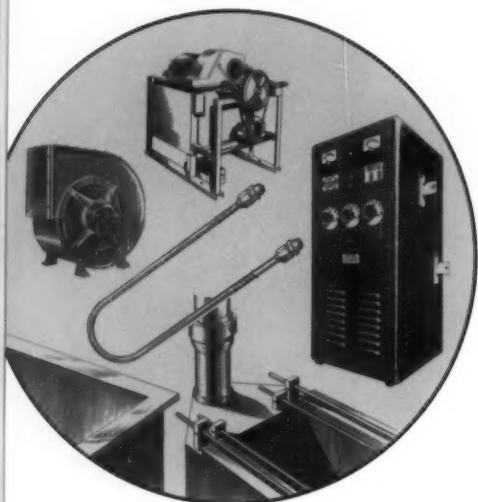
Unichrome "Super 5300" Plastisol

This sprayable vinyl plastisol costs less to apply than sheet lining, gives seamless protection. On tank interiors, it seals solidly against corrosion; on exteriors, it gives a "lifetime" coating.

Neochel®

This recent M&T development improves all cyanide copper and bronze baths. It increases cathode and anode efficiency, cuts cyanide consumption, smooths the deposits, minimizes effect of contaminants. Platers report it outperforms any other additive.





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Chromium Plating Barrels

M&T has to its credit the development of the first successful barrels for chromium plating. A *continuous* plating type handles up to 200 pounds of parts per hour. A Unichrome Barrel for *batch* plating is also available. Both types plate high quality chromium that shows no contact marks. They turn plating of small parts into a practical and profitable operation.

Anodes

Essential to the plating process, anodes have shared in M&T research efforts. The cylindrical lead-alloy anode for chromium plating was originated by M&T and is now available in ribbed or smooth round design. For tin plating, M&T "High Speed" (pat.) Tin Anodes operate at high current densities. M&T also supplies anodes for zinc, copper, nickel and cadmium plating.

Tantalum Equipment

Introduced by M&T, UNICHROME HEATING COILS of acidproof tantalum have proved their ability to increase efficiency, reduce maintenance and downtime, cut costs.

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Other Equipment

M&T also supplies still tanks, temperature controllers, ventilating fans, cathode agitators, moisture extractors, and other specially engineered equipment. Information and quotations on request.

Detailed literature and technical information is available. Remember that technical service accompanies all M&T processes and products. It is given willingly. It is plating-minded. It is supported by long experience in the field.

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by Ben P. Sax

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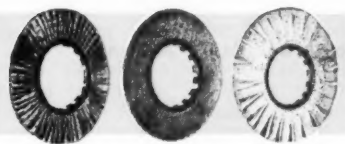
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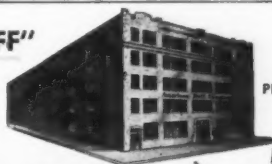


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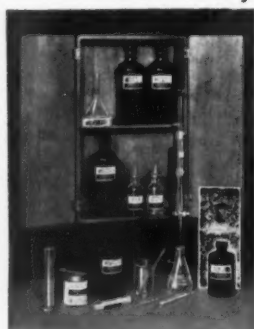
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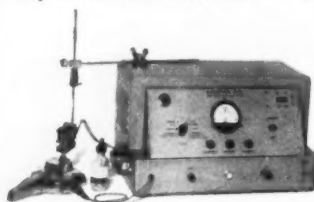
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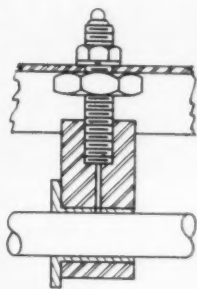
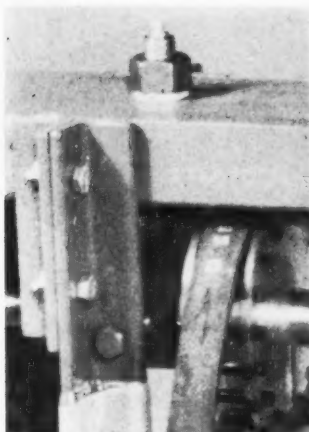
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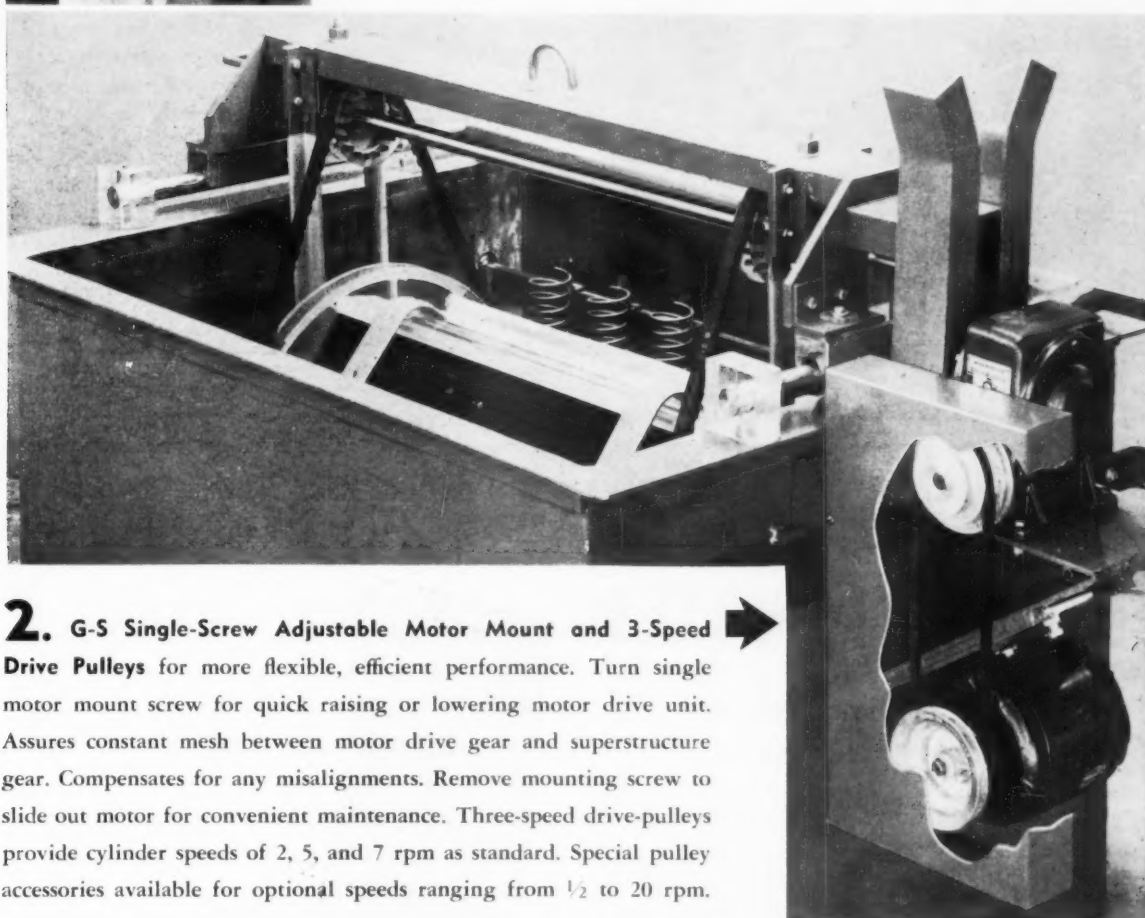
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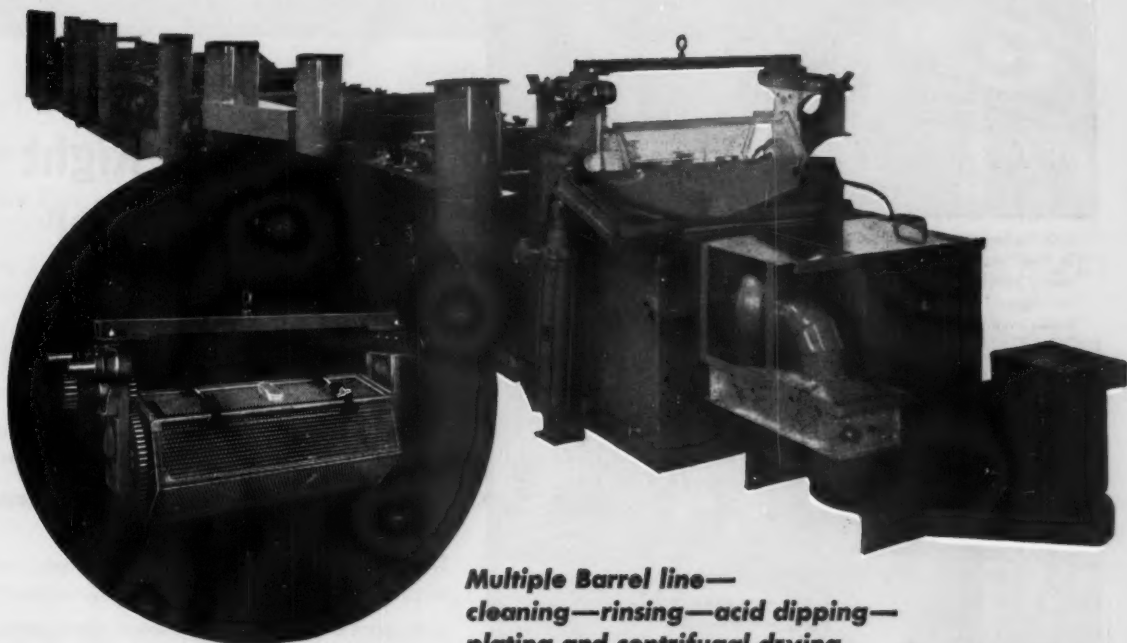
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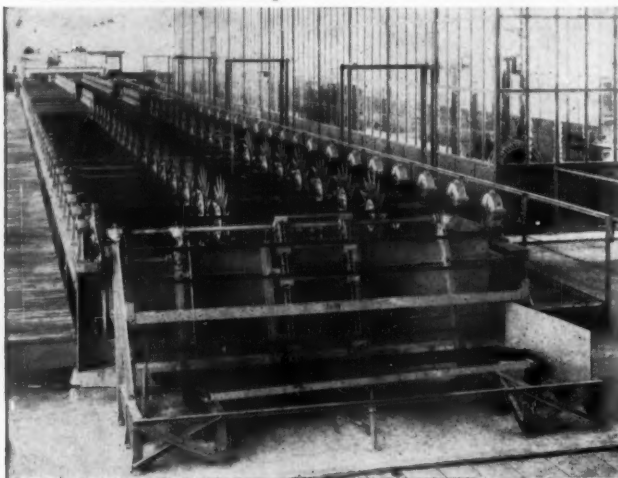
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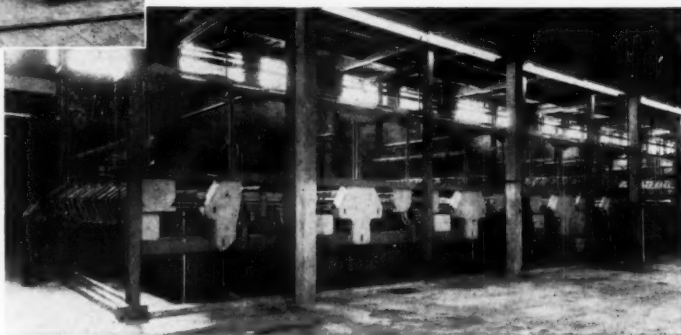
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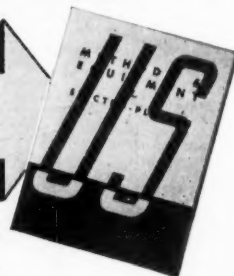
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JULY, 1959

Volume 57 No. 7

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Metal Finishing

POLISHING AND BUFFING • BARREL FINISHING • CLEANING
PLATING • ANODIZING • RUSTPROOFING • LACQUERING & ENAMELING

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CONSUMER EDUCATION

Glancing through our favorite daily newspaper recently, we came across a reference to "sheets of galvanized tin." Of course, we still do not know whether the reporter meant galvanized iron or whether he was referring to tinfoil, and we doubt whether he would have known the difference anyhow, although recourse to Webster at least would have informed him that galvanized metal is zinc coated. The news item, however, started us wondering whether our industry hasn't been falling down on the job of educating the buying public.

Most large industry associations go to great lengths to publicize their particular products and point out distinguishing characteristics and advantages, mainly the latter, whether it be hardwood flooring, plastic upholstery, stainless steel or Florida oranges. Offer a better finish, however, and the public wouldn't exhibit the slightest interest! Why? Is it because, from time immemorial, plating has been recognized only as a cheap imitation of the solid metal rather than a product which can stand proudly on its own reputation?

Only because the consumer is unfamiliar with finish quality can stores advertise copper-nickel-chromium plated appliances as "triple chrome plated," even though the plating is too thin to withstand anything but the mildest treatment. They can proudly boast that their flatware is "A-1 silverplate" by Government standards only because the buyer doesn't know this is the lowest standard, with a silver thickness of but 0.0002". It isn't as if we couldn't do better. We don't even try, it seems! As a result of apathy on the part of producers, the revised Federal Trade Commission rules for the jewelry industry continue to prohibit the use of terms such as "Gold Plate," "Gold Filled," and even "Gold Plated" for electroplated articles, though the finish could easily be superior when produced from the hard, bright gold alloy baths.

When a poor finish quickly fails, it is chalked up as confirmation of the deficiency of plating in general, and our whole industry receives a black eye. Yet, with our future at stake, and despite the existence of not one, but three industry associations — technicians, suppliers, and contractors — practically no attempts have been made to explain to the buying public what it should expect of a plated finish. Other industries have prepared booklets which enlighten the consumer. Why can't we do the same? If a purchaser knows how much thickness of deposit is considered good quality, he will start looking for figures on the labels and, if he doesn't find any, at least he will be put on warning. Eventually, a plated finish will thus come to signify, not a mediocre substitute for the real thing, but a guarantee of quality.

Nathaniel Hall

Surface Finishing Stainless Steels

By Lester F. Spencer, Technical Advisor, Nuclear & Centrifugal Pump Div., Allis Chalmers Mfg. Co., West Allis, Wisc.

THE preference of the stainless steels for home, commercial and industrial applications can be attributed to two outstanding properties—resistance to both corrosion and heat. Although both of these properties are of equal importance, corrosion resistance and its relationship to surface finishing is of immediate interest; this property is considered to be at its maximum value for all types of stainless when they are in a highly polished condition. In considering that classification known as the “martensitic” stainless steels, the properties of which will be covered in more detail, it is well to know that the maximum corrosion resistance of this group is present when the material is in a properly heat treated condition.

The mechanism involved explaining the corrosion resistance of the stainless steels is based on the ability of these materials to form a thin oxide film on the surface of the metal which acts as a buffer against further corrosion of the underlying metal. This oxide film is considered to be stable, adherent and self healing. Thus, in the event that this film is broken through a mechanical abrasion action, a new film will form upon exposure to an oxidizing agent and thus re-new its function as a protective agent. Although the degree of corrosion resistance is governed by the total alloying content within any specific composition, it is generally conceded that chromium is the major element essential in the formation of this film, its effectiveness in resisting corrosion under oxidizing conditions increasing as the chromium content increases within the base composition. The presence of nickel within the stainless steels apparently has the function of stabilizing this thin protective film under conditions that are non-oxidizing, while molybdenum additions up to 3 per cent within the 18-8 analysis (type 316) will improve resistance to pitting.

Oxidation resistance is also considered to be a function of alloying content; the elevated temperature at which an analysis can perform satisfactorily increasing as the chromium content increases in a straight-chromium type stainless steel. Where the combination of both oxidation and corrosion resistance is

required, the chromium-nickel stainless steels are employed.

Types of Stainless Steels

The stainless steels cover a wide range of chemical compositions, within which may be found an analysis for almost every purpose. In general, it is sufficient to state that all of these alloys may be conveniently tagged in any one of three divisions, namely: (a) the austenitic stainless steels; (b) the ferritic stainless steels; and, (c) the martensitic stainless. This division is based on metallographic structure and, due to this variance in structure, each division has individualistic characteristics. These may be identified as:

THE AUSTENITIC GROUP:

Alloys within this group contain nickel (6.0 to 36.0 per cent) and chromium (14.0 to 30.0 per cent) as the chief alloying elements. These austenitic alloys are non-magnetic in the annealed condition and do not harden by the conventional procedure of heat and quench. They may, however, be cold worked to develop a wide range of mechanical properties and, in this condition, may become magnetic.

There are two developments within the austenitic group of alloys which should be mentioned, namely: (a) the chromium-nickel-manganese alloys in which the reduction of nickel within the composition is accomplished by the use of manganese as the substitute element, and (b) the precipitation hardening stainless whose composition is altered to an extent that will permit the use of a low temperature hardening treatment.

THE FERRITIC GROUP:

The alloys within this group contain chromium (14.0 to 27.0 per cent) as the major alloying element. These alloys do not harden to any appreciable extent when quenched from a high temperature, and are magnetic at all times. They develop their maximum softness, ductility and corrosion resistance in the annealed condition.

THE MARTENSITIC GROUP:

The alloys within this group also contain chromium (11.5 to 18.0 per cent) as the major alloying element. However, due to the proper balance of chromium and carbon within these compositions, these alloys respond to a standard heat and quench heat treatment. These alloys are magnetic and their maximum corrosion resistance is obtained when the material has been heat treated.

Commercial Mill Finishes

The degree of surface finishing that is required to obtain a specific luster on fabricated parts is frequently related to the surface condition of the purchased form whether it be sheet, strip or plate. This fact necessitates a knowledge of existing specifications as to the mill finishes as applied to the various shapes available on the commercial market. These mill finishes on wrought material, which have been standardized throughout the industry by AISI (American Iron and Steel Institute), are as follows:

SHEET FINISHES:

As is indicated in the table, a wide variety of surface finishes is obtainable in sheet stock as purchased from the mill. In addition, the table suggests a sequence of operations required to obtain these finishes. As to choice of surface finish, the two interdependent factors which should be considered would be (a) the type of operational procedure required to produce the finished part, and (b) the specified surface finish of the completed part. Comments on these available sheet finishes are given, thus:

No. 1 Finish—This finish represents a white, pickled surface and is commercially identified as a hot rolled, annealed and pickled sheet. As a rule, sheets of this type are used when finished articles do not require extensive polishing and buffing—this being exemplified by internal parts. An exception to this practice would be deep drawing or spinning where the sequence of forming, annealing, and pickling would destroy the higher mill finishes.

No. 2D Finish—Sheets of this class possess a dull but smooth and dense surface which is produced by

Suggested Sequence of Operations for Grinding, Polishing and Buffing the Stainless Steels

Finish*	Operation Sequence	Abrasive	Lubricant	Wheel		
				Type	Size**	Speed***
Welds		Abrasive Oxide Grit No. 40-60	Dry	Rubber or Bakelite Bonded	4-8	4000-6000
No. 1	1	Aluminum Oxide Grit No. 60-80	Tallow or Grease Stick	Shop Headed or Factory Coated Wheels or Belts	12-14S 5- 6P	6000-8000
No. 2D or No. 2B	2	Aluminum Oxide Grit No. 80-100	Tallow or Grease Stick	Shop Headed or Factory Coated Wheels or Belts	12-14S 5- 6P	6000-8000
No. 4	3	Aluminum Oxide Grit No. 150	Tallow or Grease Stick	Shop Headed or Factory Coated Wheels or Belts	12-14S 6P	6000-8000
No. 6	3B	Pumice, Lime or Silica Flour	Oil and/or Kerosene	Tampico Brush	8-16	2500-5000
	4	Aluminum Oxide Grit No. 180	Tallow or Grease Stick	Shop Headed or Factory Coated Wheels or Belts	12-14S 6P	6000-8000
No. 7	5	Aluminum Oxide Grit No. 240-280 Abrasive Stick		Buff	12-14S 6P	9000-10000
	5B	Stainless Buffing Compounds		Buff	12-14	7000-9000
	6	Aluminum Oxide Grit No. 320-400 Abrasive Stick		Buff	12-14S 6P	9000-10000
No. 8	6B	Stainless Buffing Compounds		Buff	12-14S 6- 8P	7000-9000
Scratch Free Mirror	7	Stainless Buffing Compounds		Buff	12-14S 6- 8P	7000-9000
	8	Stainless Buffing Rouge		Buff	12-14S 6- 8P	7000-9000

*Sequence of finishes which can be produced when starting with No. 1 pickled finish or No. 2D or No. 2B cold reduced finish.

**Wheel diameter in inches.

***Speed in surface feet per minute.

NOTE:—Operations 3B, 5B and 6B are special steps to finish off at the respective No. 6, No. 7 and No. 8 finishes. When working through to a higher finish, B operations are not used. S = Wheel diameter for stationary machinery. P = Wheel diameter for portable machinery.

a cold rolling operation prior to the final annealing and pickling operation. Material in this condition has maximum ductility and is selected where severe reductions in cold working are encountered, as exemplified in deep drawing and spinning. Polishing and buffing operations will vary in accordance with the specified luster condition of the completed part.

No. 2B Finish—Sheet material within this classification has a bright, reflective surface that approaches a lustrous appearance. Due to its slightly harder temper, as compared to No. 2D, it cannot be press-drawn quite as deeply, nor can it be formed as easily. However, the cold working qualities are adequate for moderate working, as exemplified by the forming of shallow pans, serving trays, and decorative stampings. In addition, when the sequence of operation does not include either annealing or pickling operations, an advantage is gained in that this finish has a better surface on which to begin polishing operations.

No. 4 Finish—Sheet material within this classification has the standard polish on either one or both sides; all imperfections are removed to produce a uniform bright finish with good luster. Finish No. 4 is not used for extensive forming operations, but rather, in shallow drawing and other forming operations where the original finish can be protected. It is used on applications that require ease of cleaning and where both a pleasing appearance and corrosion resistance are the major requirements.

No. 6 Finish—In this finish, the reflectivity of a No. 4 sheet has been somewhat dulled to a soft, velvety surface. This finish is frequently called "tampico finish" and is used in architectural work where glare or brilliant reflections are undesirable. It is also used to advantage for a contrasting effect with higher finished sheet.

No. 7 Finish—This finish, which is referred to as a "high luster polish," represents a very highly desirable surface. As a result of extensive polishing and buffing, this sheet possesses an attractive gloss approaching mirror reflectivity.

No. 8 Finish—This finish represents a very highly developed surface which is similar to that of No. 7 in that it has a mirror luster.

STRIP FINISHES:

The stainless steels in strip form are available in a variety of hardness levels which would range from the relatively ductile, fully annealed strip to strip stock which has been re-rolled to produce the various commercial tempers up to full hard. Commercially, in accordance to AISI standards, the above stated conditions for strip stock can be classified as:

No. 1 Annealed and Pickled—This finish, which is associated with fully annealed material, is usually employed where the forming operation requires maximum ductility. A variation in smoothness of surface may be noticed between heavy and light gauge material.

No. 2 Annealed, Pickled and Re-rolled—The re-rolled finishes, which may vary from a light pass to those of substantial reductions to develop high tensile properties, normally are limited to the chromium-nickel stainless steels (austenitic grades). The amount of

forming permissible is a direct function of the degree of re-roll.

Selection of Sheet Finishes

The governing factor in the selection of sheet finish for a specific application would be a consideration of the type of forming operation that will be used for fabrication. This decision is frequently tempered by the economic factor. Thus, due to both the relative high cost and greater difficulty in obtaining the luster type finishes, which have mirror reflectivity and are scratch free, a compromise is frequently made between sheet formability and sheet finish. As an example, a deep drawing operation will normally specify a No. 1 finish, particularly when extensive polishing and buffing are not required. Where the formed shape is deep-drawn and requires finishing operations, the ductile No. 2D finish is specified. Where this formed part is not drawn too severely, the No. 2B finish may be a wise choice, since the higher initial finish of the raw material will reduce finishing operations on the completed part. As this fabrication factor becomes less and less severe, as indicated in brake forming, roll bending, etc., greater advantage of reduced finishing costs on the fabricated item may be realized by the use of the higher sheet finishes. In some instances, it may be absolutely necessary to start with a high finished sheet, since the fabricated item may be too complicated effectively to produce the desired finish economically.

Since the use of a highly polished sheet will mean higher material costs, it is essential that protective measures are taken to preserve the surface finish during fabrication. In the event that this mill finish is damaged during fabrication, it should be remembered that it is difficult to match, by hand polishing, the finish obtained with polishing machines at the mill. One suggested procedure would be the use of highly polished dies; however, it is necessary to stone and polish these dies whenever there is any sign of metal pick-up since this may easily scratch the material. The use of adhesive tape on the contacting surfaces of the dies is frequently recommended where working is not too severe, as in hand-brake bending. The merit of this type of protection is evident, since it will prevent direct contact between the hardened surfaces of the die and the polished sheet surface. A very common procedure to obtain surface protection is the use of a high quality paper which is pasted on the material prior to fabrication and subsequently removed by soaking in water after forming has been completed. Following this same line of thought, the more modern methods of coating would be the use of sprayed or brushed latex or plastic base compounds.

Characteristics of the Stainless Steels

Stainless steels are readily conditioned by those mechanical operations of grinding, polishing, and buffing and, in general, these processes are conducted in much the same manner with the standard equipment used in the surface finishing of other metallic materials. However, it should be realized that this group of materials has basic characteristics which will result in a variance in operating detail. These characteristics which distinguish the stainless steels would include:

1. A high tensile strength which will determine the power necessary for metal removal. This higher strength, in conjunction with both a greater hardness and increased abrasion resistance, will result in less metal removal as compared to carbon steel under identical conditions. The normal reaction of increased pressure to obtain a more rapid metal removal should be discouraged. Since the stainless steels have less than half the thermal conductivity of carbon steel, increased pressure may cause overheating which may produce discoloration, possibly undesirable warpage and, in extreme cases with the austenitic stainless steels, may even affect the corrosion resistance of the material.

2. A second consideration is the higher coefficient of expansion displayed by the austenitic stainless steels. This factor, which is approximately 40 per cent higher than that displayed by the carbon steels, in combination with a low thermal conductivity, will cause buckling and distortion if the work is overheated during the finishing operation. This is especially true where the work is of relatively thin gauge.

3. Another consideration, particularly in the martensitic and ferritic grades, is the tendency to score and gall. This makes these grades difficult to polish and results in loading of the wheels; the sharp corners or edges producing objectionable scratches. This is particularly true when the wheels are canted in operation. This indicates that one should observe the frequent dressing of wheels for polishing and the allotment of sufficient time to produce the desired finish.

4. In the case of the austenitic stainless steels, which work harden quite rapidly, there may be the possibility of developing residual cold-work stresses at the surface that may increase susceptibility to stress-corrosion attack under extreme conditions.

Recommended Procedures

GRINDING:

This operation implies the removal of metal, which may or may not be conducted as a preliminary operation for further polishing and/or buffing. Grinding may be compared to fast milling in that metal removal is accomplished by the action of many small abrasive cutting edges irregularly positioned in a holding device such as a solid wheel or an adherent facing on a set-up cloth wheel or belt. In addition to the use of grinding as a preliminary conditioning operation, it is frequently used for removal of excess metal on weldments, forgings, and castings. It is considered as a roughing operation where coarse grits are employed; however, it also embraces the use of finer grits, and it approaches polishing as the refinement of the surface increases. The dividing line between fine grinding and polishing is not always clear-cut since both operations involve the removal of metal. The difference may be only one of degree.

Solid wheels, which are commercially available in a wide assortment of diameters, widths, and shapes, are used for coarse grinding and would include the vitreous and rubber or plastic bonded types. A prerequisite is that these wheels be free cutting to avoid loading and glazing. Grit size will vary with the work

type; No. 20 to No. 36 being used for coarse cutting, whereas grits up to No. 60 are used for subsequent finishing cuts. The abrasives that are commonly employed would include both the aluminum oxide and silicon carbide. Surface speeds, which normally range from 5000 to 6000 feet per minute, are usually recommended by the manufacturer and, since considerable research has been done in correlating wheel types and speeds for efficient cutting action and safety, their recommendations should be followed.

Set-up wheels carry abrasives of relatively coarse grit size, glued to the periphery of wheels which are composites of fabric. These coated wheels are used for both grinding and polishing; the essential difference being the grit size and the rate of metal removal. Details as to wheel composition, wheel make-up, and grit types will be given in more detail under polishing.

Grinding wheels should be stored in a clean, dry atmosphere. Those wheels used for stainless finishing should not be used on other materials, since forced-in particles of foreign materials may contaminate stainless steel surfaces and seriously affect their corrosion resistance. It is also essential that grinding wheels be kept dressed and true to shape to avoid such difficulties as grooving and chatter marks. The undesirable overheating effect, which may result in warpage in relatively thin gauge material, decreased corrosion resistance of the austenitic grades by the development of intergranular carbides, and the reduction of hardness in the heat-treated martensitic stainless grades, must be constantly watched. Thus, it is considered good practice to keep a grinding wheel moving in sweeps or strokes of 20 to 30 inches, as is possible when grinding flat or open work with a portable tool. Wheels should always be held in normal position to avoid scoring or grooving.

Progressive grinding refers to a succession of operations in which wheels of decreasing grit size are used. The direction of wheel traverse across the work is changed by 90 degrees with each grit in order to remove the grinding lines made by the previous grit. It is essential that the work surface be cleaned thoroughly to remove any abrasive particles or metal cuttings that may mar the performance of the finer grits. This graduation of coarser to finer grits may be made in increments of 20 to 40 size designations, the actual selection being based on individual experience as well as recommendations of suppliers.

Of ever increasing importance is belt grinding, in which belts carrying abrasives of various grit sizes are used for surface finishing operations. These belts are available in many widths ranging from those used in grinding wide sheets to narrow sizes for work on relatively small parts. Examples of the latter type are belt grinders and polishers employed in the manufacture of parts such as cooking utensils. In this method, the cutting abrasive is carried by an endless belt which travels over two pulleys. One of these serves both as a drive pulley and as the work or contact wheel. It is constructed so as to provide the flexibility and softness that ordinarily would be offered by a grit-coated wheel. The other pulley is simply an idler unit which can be adjusted to provide proper tension and control tracking. The advantages usually given to

belt abrasion work include: (a) adaptability of flexible wheels to both manual and mechanized grinding and polishing; (b) uniformity of grit distribution over the face of the belt; (c) greater expanse of grit coated surface, which aids in a better removal of frictional heat; (d) elimination of a bonding zone which promotes uniformity of softness and flexibility in the wheel structure; and, (e) elimination of actual make-up and maintenance of wheels within the shop.

Weld Bead Grinding—An excellent example of progressive grinding and polishing is the procedure used in weld bead grinding. The importance of this operational procedure is self evident when one considers that welding is one of the more widely used procedures in the fabrication of the stainless steels.

Excess metal in weld beads is normally removed by grinding, although an initial cut may be taken with a cold chisel when the size of the bead warrants. Progressive grinding may be used, observing the precautions mentioned previously as the grit size changes from coarse to finer abrasive. Care must be exercised to avoid canting the wheel, otherwise grooves may be cut parallel to the bead and undesirable thinning may result. This may be followed by progressive polishing, after which both cut and color buffing are used.

When the grinding operation is followed by polishing, it is necessary to terminate the grinding sufficiently above the level of the basis metal so that any final treatment used for matching will not produce a ridge or a groove. Stops or limiting lugs attached to portable grinders on either side of the wheel will effectively limit this cutting depth. In addition, it is a good idea to protect adjacent surfaces with a coating of paper.

In a sequence of operations such as this, it should be realized that there is no short cut in producing a finish of mirror reflectivity without flaws or deep scratches. It should also be remembered, whether it be weld bead grinding or finishing of fabricated parts, that the success of polishing or subsequent buffing is directly dependent upon the condition of the basis surface. Any defects that may be on the surface of the part should be removed by spot grinding or spot polishing. These preparatory operations should be conducted so as to avoid depressions or grinding marks that may be difficult to remove in subsequent operations when finer grits are employed. A suggested sequence of operations for obtaining various finishes is given in the table. Deviation from this suggested practice is to be expected since actual procedures are not constant from plant to plant.

In the interest of fabrication cost control, the amount of grinding of a weld joint in cold rolled or polished sheet may be held to a minimum by judicious choice of welding process. Thus, there may be some merit in utilizing an inert-arc gas-shielded process for the express purpose of limiting the size of the weld bead. It may even be possible to dispense with grinding and proceed immediately with the use of the finer grits employed in polishing operations.

POLISHING:

As indicated previously, the line of demarcation between grinding and polishing is not always clearcut;

however, they have one thing in common in that both operations are basically abrasive cutting treatments for surface conditioning. There is a difference in degree in that the polishing operation attains smoothness of surface, whereas, grinding is frequently associated with a more rapid metal removal by the use of coarser grit abrasives.

Polishing operations are conducted with set-up wheels in which abrasive grits of 80 mesh and finer are employed. The wheel, which simply serves as a grit holder, should have specific characteristics which include: (a) sufficient strength to hold its shape under high rotational speeds; (b) ability to provide a good bonding base for the glue; (c) ability to provide the desired amount of resiliency so essential in polishing; and, (d) ability to withstand heat. Wheels are made by assembling cloth discs into sections by sewing or by using an adhesive. These sections in turn are assembled into wheels of the desired face width. Their resiliency as well as their hardness depends upon such factors as the material from which the wheel is made, the method of stitching and glue bonding, etc., this being of considerable importance since it controls the cutting action of the abrasive. In general, a hard wheel will cut faster than a soft wheel under similar conditions of speed, pressure, and grit size. Also, hard wheels are frequently used with coarse abrasives, while the softer wheels are generally reserved for the finer grits. Correlation studies have been made with stiffness of buff and such factors as rate of metal removal, wheel life, and degree of finish obtained.

In shop heading practice, the various grit sizes to be employed should be closely screened for uniformity of size. The presence of a few grains of a coarser grit will cause scratches which may be quite difficult to remove in succeeding operations. This is the reason that mixed or contaminated abrasives is not permitted under any conditions. Each grit size should be kept separate, and all equipment, also the operator's hands, must be clean and free of abrasive before proceeding to the next operation.

In addition, it is essential to avoid the presence of iron in both the abrasive to be employed and in the lubricant. This is particularly true in finishing the austenitic stainless steels since contamination of the finished surface may result in impairment of the corrosion resistance of the material. In general, the initial grit size used on a pre-ground surface is set at about 20 numbers finer than the last grit used in grinding, after which the progressive steps in polishing would produce a step-up in fineness of about 30 to 40 numbers. Each succeeding treatment of a progression is continued until all residual marks of the preceding cut are removed.

Although both the aluminum oxide and silicon carbide grits are used in polishing operations, aluminum oxide is preferred since it has a heavy wedge shape that is tough and resistant to wear. It is capable of resisting re-fracture under mechanical pressure at high speeds. Grease in stick form is applied to wheels carrying grits of 150 mesh and finer to fine the cut. Although the artificial abrasives are preferred in the coarser grit sizes, preference has been shown for Turkish emery in the finer grits, No. 150 and better.

This preference is based on its mode of wear; it wears by rounding rather than by fracture, which is said to produce better color. An added advantage is that it is iron-free.

Polishing speeds are generally somewhat higher than those used in grinding. A typical speed for wheel operation is 7500 surface feet per minute. In the absence of previous experience, it is advised that fabricators invite and govern themselves by the advice that is given by the suppliers of polishing wheels, belts, and abrasives on matters pertaining to the selection and use of their products, including wheel and belt speeds.

BUFFING:

Both cut and color buffing should be employed after polishing has been completed, and any attempt to combine these two operations should be discouraged. Buffing may easily develop into a costly and time-consuming operation, especially where a scratch-free, mirror finish surface is required. This requires a judicious selection of operational procedures, not only in buffing, but also in preliminary grinding and polishing operations. Here again, the success that is experienced in buffing is dependent upon the quality of the surface to be buffed, the avoidance of contamination, and the application of just sufficient pressure to perform the intended purpose.

Cut-down buffing is used after polishing is completed, in which the last grit size used is about 200 to 250 mesh. The fine scratches that remain are removed by the use of a buff that carries no glued-on abrasive. Instead, such abrasive as is needed is applied intermittently to the buffing wheel by rubbing a cutting compound in bar or stick form against it as it rotates. These cutting compounds contain a stiff grease as a binding and a very fine artificial abrasive that has a grit size of about 300. They adhere to the wheel by impregnating the cloth discs. The operating speed is usually from 9000 to about 10,000 surface feet per minute.

The color buffing operation is very similar to the cut-down buff with the exception that a coloring compound is employed and the operational speed of the wheel is held below 9000 surface feet per minute. A varied assortment of compounds, normally rouges, are available for use with the stainless steels.

Mention should be made of the use of a color buff without previous polishing or cut-down buffing operations. This is used on products that have a fairly good finish and where it is felt, for the sake of economy, that a reduction of finishing is required. It should be realized that a color buff will not remove scratches or surface imperfections. Examples in which a color buff may be employed would include: (a) small articles blanked from a bright finished strip which may be tumbled for burr removal and color buffed for brightening; (b) molding made from bright, cold rolled strip that is given a preliminary cut-down buff with a 300 grit and color buffed; and, (c) color buffing of defect-free surfaces that have been previously electropolished.

Tampico finish on stainless is quite pleasing, free from streaks or coarse scratches, and without glare.

This type of finish is similar to the 'butler' finish that is produced on silverware. It may be obtained on a surface that has a No. 4 or higher finish by rotating a tampico fiber brush, utilizing a light paste of fine abrasive and oil as a lubricant. No appreciable pressure is required, the cutting action depending upon both the abrasive and the wheel speed. Fibers of the wheel should not bend to any considerable extent when in contact with the surface to be brushed. In many instances, a moist and humid atmosphere is desirable for this type operation. A tampico finish frequently is more economical than to attempt to buff surfaces from which the scratches have not been completely removed.

Although details of buffing wheels will not be given, it may be stated that they are similar to polishing wheels in that they consist of assemblies of sections which, in turn, are made up of a varying number of individual cloth discs. However, buffing wheels must differ in construction since they are operated at relatively high speeds. These basic characteristics would include: (a) sufficiently high strength to withstand the speed; (b) a texture that will be compatible with a buffing compound; (c) a design with spacers between individual sections to withstand the high temperatures realized during a buffing operation; and, (d) maintenance of both the flexibility and softness of a buff by the control of both the location and amount of stitching within the buff design.

WIRE BRUSH FINISH:

Wire brush finishing is practiced widely, producing a very pleasing appearance. This method is used widely on the inside of containers and has the advantage of hiding surface defects. One prerequisite is that the brush material be of the same composition as the material to be wire brushed. Thus, never use a steel wire brush for scratch brushing the stainless steels since contamination of the surface will result and the embedded iron particles will rust. This will give a false impression to the uninitiated that the stainless material is not corrosion-resistant, and may be a source of embarrassment when consumer goods are returned for this reason. In many instances, in order to prevent the above condition, a precautionary passivation treatment may be employed after wire brushing.

Conclusions

1. The characteristics of the stainless steels will determine the procedure which is used in grinding, polishing, and buffing operations. The more important factor is the utilization of the correct wheel pressure so as to minimize or completely eliminate overheating.

2. In the preparation of set-up wheels, the factor of cleanliness is important. This includes both the screening and separation of the various grits and the cleanliness of equipment. In many instances, it is essential to reserve special equipment for various grits.

3. Both the abrasives and lubricants should be iron free. There are many suppliers of iron free abrasives and lubricants for the finishing of the stainless steels.

4. In finishing operations, particularly in polishing, the abrasive scratches should be straight and

(Continued on page 58)

Better Buffing Thru Better Buff Design

By Stanley P. Sax, American Buff Co., Chicago, Ill.

This is the second and concluding installment of this article on buff design. Part I appeared in our June issue.—Ed.

Centerless Buffs

AFTER the steel center buff was on the market a good many years, the centerless buff was developed. By centerless, is meant a wheel made up of a number of buff sections that does not require the usual cardboard discs, or steel center plates. By interlocking, the buffs support each other and only require end plates or flanges to adapt the wheel to the shaft. All buffing wheels require flanges for proper safe operation. These centerless flanges fit standard center buffs as well as centerless. The centerless buff results in several superior design characteristics. Superiority is due to the cooler running, air conditioned open center and pre-assembled interlocking design.

Less overheating takes place, with resultant longer buff life and, of course, reduction of the fire hazard. The cooler, centerless design results further in fewer heads needed and fewer passes, faster cut, increased production, and superior finish. It also enables the use of increased pressures and dwell time.

The pre-assembled interlocking characteristics result in faster changeover, and less machine downtime due to ease of loading and unloading. There is superior compound head retention, even when the wheel is removed from the shaft, set aside, and replaced at a later date.

As a belt contact wheel, the centerless buff is excellent for the above reasons, and also because of non-slip and non-spin characteristics. Special centerless buffs are used as polishing wheels, the main advantage being the possibility of adding or removing buff sections, thus widening, narrowing and changing the contour of the wheel.

Polishing wheels are normally made of buff sections glued together, whereas, centerless polishing wheel sections require no glue, achieving a more uniform density. The lack of glue between buff sections also allows for softer wheels with better part coverage. Hence fewer wheels are needed for the part to be finished.

A corollary benefit of the centerless buff is that the flange which holds the buff on the shaft is virtually indestructible. This is caused by the domed shape and locking-in design. The flange may be in-

verted and used on any type of buff. A special flange is available which allows one to buff the inside of a cylinder, such as a pot, or light reflector, by recessing the shaft and retaining nut entirely within the buffing wheel.

A centerless wheel will fit any size shaft up to and including the inside diameter of the wheel itself. This is usually seven inches. In shops where various size shafts are in use, it may otherwise be necessary to carry inventory of each type buff or each size shaft. The centerless fits all size shafts.

Buff Treatments

Bufs may be treated with substances to increase lubrication, cloth strength, buff body, and compound retention, but the treatment must not leave a film on the work. Since some will possibly be retained by the part, it must be easily cleaned by the process in use by the specific plant. It must not interfere with a subsequent plating operation. Bufs may also be treated to raise the kindling point, or to flameproof them entirely. However, there is little danger of fire with properly ventilated and properly constructed and treated centerless or steel center buffs. Therefore, the cost of flame-proofing is usually not warranted when weighed against the additional buff life and compound retention imparted by other treatments which

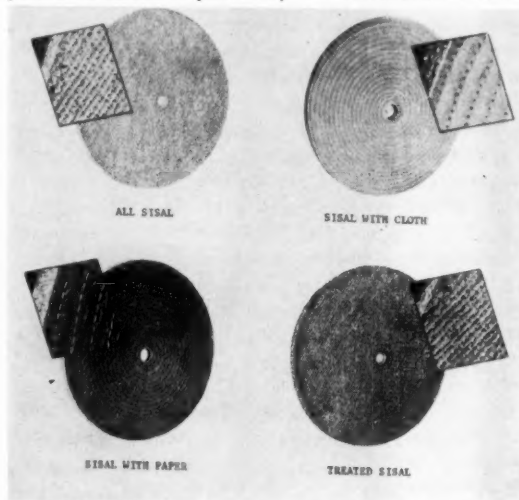


Fig. 7.

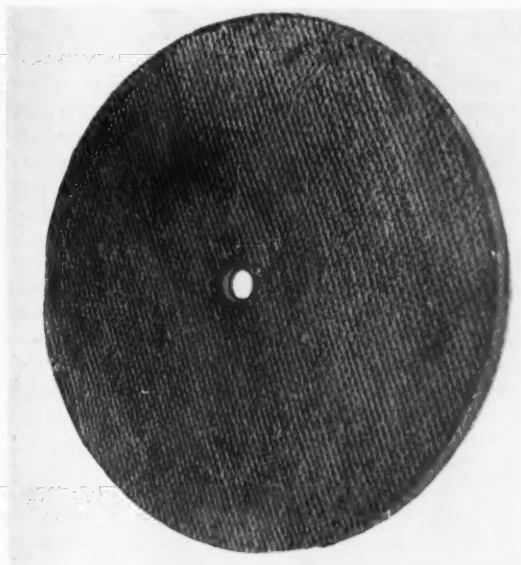


Fig. 7a. Conventional Sisal.

are also partially fire retardant. Various chemicals have been applied to buff material before assembly, and also to finished buffs. These treatments are identified frequently by color, or they may be identified by effect, such as hard, soft, abrasive, flameproof, etc.

The purpose of the treatments may be to harden for additional cut; to soften for additional flexibility in getting into contours; to strengthen for longer buff life; to lubricate to prevent burning; to adhere for retention of buffing compound; to abrade for heavier cut; to flameproof to raise kindling point, or completely prevent fire. Treatment alone is not enough. The treatment must be basically sound and suited to the job.

The treatments should be applied evenly and uniformly, avoiding hard spots and imbalance. Treatment must not deteriorate rapidly with age. Some treatments actually weaken the cloth, resulting in decreased buff life.

Sisal Buffs

Sisal became important as a buffing material during World War II, due to the shortage of cotton sheeting. It is a long coarse fiber that is twisted into strands and frequently woven into a fabric. It has a much lower thread count than cotton cloth, often in the neighborhood of five strands by seven strands per inch. It took some time for the industry to learn how to use sisal buffs, and for the buffing compound manufacturers to develop compounds to bring out its important advantages, of toughness, great structural strength, and resistance to deterioration by buffing compounds. At first, sisal buffs consisted of material from used coffee and chickie bags, laid flat, cut in circles, and sewed spirally. Some are still made with these materials. In time, however, sisal was woven and imported for the sole purpose of use as buffing material. Naturally, the mill rolls were cleaner and more uniform. In addition, the material was improved in other ways.

Cloth covers were frequently used, as the sisal had a tendency to cut the cotton threads of adjacent buffs. Cloth was used in the interior of the buffs to provide a better base for the stitching and to improve compound retention and reduce unravelling (Fig. 7). Krinkle kraft paper is also used with sisal to increase cut. Spiral sewing is preferred on conventional sisal buffs. Finally, the equipment used to pucker cloth buffs was adapted to sisal buffs and had the same advantages that puckered cloth buffs have over conventional buffs (Fig. 7). The advantages of puckered sisal over conventional sisal buffs are even greater, however, due to the low count, coarse weave of sisal. Fray is reduced tremendously. To further reduce the tendency to fray, treatments have been developed that help to bind the fibers together. A flat puckered sisal buff has been developed for jobs requiring a hard sisal buff. Hard treatments have added even more cut and sisal has taken the place of some fiber polishing operations and many deburring and brushing operations.

The bare metal process (buffing of steel followed by copper, nickel, chromium plating) resulted in an increase in the use of sisal. Tapered puckered sisal (wider at outside diameter than at inside diameter) was introduced to eliminate gaps between these hard sections and streaking of the work.

As steel and stainless steel parts increased in contour complexity, softer treatments, wider sewing, and spacers were used. This was not enough, however, and two ingenious products were developed to fill the need.

The unit sisal, or spoke sisal, which consists of woven sisal covered and interlaced with 86/93 cloth (Fig. 8) is manufactured in endless belts and bound by rows of sewings into individual spokes, or units, puckered, doubled, and held by steel teeth. The open cloth puckered sisal (Fig. 9), which consists of woven sisal and 86/93 cloth, bound together by concentric sewing

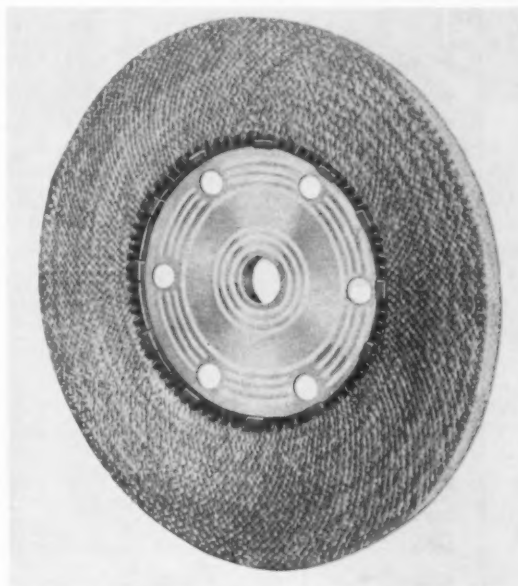


Fig. 7b. Puckered Sisal.

is manufactured in endless strips and rolled several times, puckered, doubled, and held by steel teeth. Variations of the OCPS buff are open puckered sisal (OPS), consisting of two layers of sisal, bound together by sewing, and open double cloth puckered sisal (ODCPS), consisting of two rows of cloth bound by sewing to one layer of sisal. These designs give truly flexible sisal buffs for use on contoured steel and stainless steel parts.

Unit or Spoke Buffs

The unit buff or spoke buff employs distinct design advantages. Puckered unit buffs run cooler than standard puckered buffs, have a knee-action, contour-following ability. Their pockets hold significantly greater amounts of compound. The clue to the development of this buff came from the old-timers' practice of radially cutting conventional and puckered buff sections. Thus, the unit buff did the same thing, but did it better. The width of the units may be easily controlled. The density or hardness varies almost infinitely according to plies, radial stitching, materials, treatments, and center size. Some parts would be nearly impossible to buff without this specially developed tool. This design makes it possible to have a hard

wearing buff that is also flexible. On automatics, it allows better part coverage with fewer heads and reduces cam requirements.

It is important in all buffs that the center holding device be designed properly with sufficient strength to withstand the tremendous forces and pressures sometimes exerted in buffing. High speeds, large buff diameters, sudden shocks from an automatic conveyor slamming a part into a buff, may cause failures of clinching teeth, breakage of rings, and explosions of buff sections. Equipment has been damaged and men injured by these failures. The unit design is especially vulnerable to breakdowns as each unit works independently and the individual unit may be called upon to undergo tremendous punishment. Some clinch ring designs perform consistently under these conditions without breakdown, whereas, others do not.

The advantage of separate units developed logically into the "flap" design. The flaps are placed at right angles to the direction of rotation of the wheel. Each one wipes up and cleans up after the other, which produces superior color. All flaps reinforce each other, resulting in greater wheel life. This is a very smooth running wheel, but proper pressures and speeds must be maintained to get optimum performance.

TABLE III

BUFFING CALCULATOR

Quick, easy way to find proper Surface Speed, Spindle Speed, or Buff Diameter for practically any buffing job.

R.P.M. at Arbor or Spindle	DIAMETER OF BUFFING WHEEL IN INCHES										
	4	6	8	10	12	14	16	18	20	22	24
	SURFACE SPEED IN FEET PER MINUTE										
800	837	1256	1675	2094	2513	2932	3351	3770	4189	4608	5026
900	942	1413	1885	2356	2827	3298	3770	4241	4712	5184	5655
1000	1047	1570	2094	2618	3141	3665	4189	4712	5236	5760	6283
1100	1152	1727	2304	2880	3455	4031	4608	5183	5760	6336	6911
1200	1256	1884	2513	3142	3769	4398	5027	5655	6283	6912	7540
1300	1361	2042	2723	3404	4084	4764	5446	6126	6807	7488	8168
1400	1466	2199	2932	3666	4398	5131	5865	6597	7330	8064	8796
1500	1571	2356	3142	3927	4712	5497	6284	7069	7854	8640	9425
1600	1675	2513	3351	4189	5026	5864	6703	7540	8378	9216	10053
1700	1780	2670	3560	4451	5340	6230	7121	8011	8901	9792	10681
1800	1885	2827	3770	4713	5654	6597	7540	8482	9425	10368	11310
1900	1989	2984	3979	4975	5969	6963	7959	8954	9948	10944	11938
2000	2094	3141	4189	5236	6283	7330	8378	9425	10472	11520	12566
2100	2199	3298	4398	5498	6597	7696	8797	9896	10996	12096	13194
2200	2304	3455	4608	5760	6911	8063	9215	10367	11519	12672	13822
2300	2408	3612	4817	6022	7225	8429	9634	10839	12043	13248	14451
2400	2513	3770	5027	6284	7540	8796	10053	11310	12566	13824	15079
2500	2618	3927	5236	6545	7854	9162	10471	11781	13090	14400	15708
2600	2722	4084	5445	6807	8168	9529	10890	12253	13613	14976	16336
2700	2827	4241	5655	7069	8482	9895	11309	12724	14136	15552	16964
2800	2932	4398	5864	7331	8796	10262	11728	13196	14660	16128	17592
2900	3037	4555	6074	7592	9110	10629	12147	13667	15184	16704	18221
3000	3141	4712	6283	7854	9425	10996	12566	14137	15708	17280	18850

Buffing Operations

Experience has indicated certain laws or rules that may be applied to the art of buffing. A part must be exposed to a buff surface for a sufficient length of time to achieve a desired finish. Experience determines the time required for different metal and different finishes. This may be measured in hundredths of a minute per linear inch. Therefore, the higher the surface speed of the buff, the shorter the time that will be required. Other things being equal, parts will be produced faster at higher shaft rpm's and large wheel diameters. There is an optimum surface speed for every metal and metal condition, depending also on the finish required. Contour of the work, fixtures, operator, and conveyor speeds sometimes prevent the attainment of this ideal surface speed.

Buffing machines usually are not equipped to vary rpm easily during buff wear-down. Hand machines have this facility, but full automatic machines seldom are so equipped. Even when they are, the operator may fail to use this costly added feature.

Surface speed is a function of diameter of the buff and rpm of the shaft (Table III). Naturally, as the buff diameter decreases, the surface speed decreases. Shaft speed is seldom varied to compensate for this wear-down. Therefore, it is best to choose an average usable buff diameter in determining shaft rotating speed.

Varying rpm speeds, to adapt machinery to a new job, however, is an advisable procedure, as is assuring that the machine has sufficient power to maintain the rpm during periods of heavy pressure. The motor power must be sufficient to pull the load created by the buff against the part. The power requirement becomes greater with increased surface area and increased contour of part, increased width and weight of buff head, and increased speed of rotation of shaft. Buffing departments are required to finish metals of various types. Those metals vary in hardness and structure. Different metals require different buffs designed to achieve the ultimate in finish, production, and buff-life. Buff guides based on the experience of users with all types of metals are available. They are designed to aid in the selection of the best buff. Speeds, compounds, pressures, equipment, shape of the part, and many other factors will influence buff selection.

Buffers, properly faced, are ready to accept compound immediately. They break-in faster, and start off doing a good job in the beginning. A properly broken-in buff will perform better during its entire buffing life. The user need perform no raking. Facing must not start microscopic rips in the fabric, nor pull bias sewing threads out beyond the outside diameter of the buff.

A buff must be properly designed to start off in balance and stay in balance during its entire life. Some machinery is delicately balanced. Unbalanced buffs on this machinery will cause severe shaking. Wide wheels and long shafts are not very tolerant of unbalanced buffs. Unbalanced buffs can produce a balanced wheel, but only in the hands of a skilled operator, who rotates the sections, counterbalancing

one unbalanced buff with another. A wheel made up of counterbalanced, out-of-balance sections will usually go out of balance again as it is used.

Out of balance buffs are caused by:

1. Off center arbor holes
2. Out of round center plates
3. Irregular gathering or puckering
4. Overlap of cloth
5. Improper facing
6. Irregular centers
7. Uneven treatment

Uneven buff wear, shortened buff life, poor finish, sprung spindles, and worn-out bearings, reduced production, and increased worker fatigue are results of unbalanced buffs. Table IV shows the amount of centrifugal force exerted by an imbalance of an ounce or two.

TABLE IV
Centrifugal Force on Buffs

Diam.	Rpm.	1 oz. force	2 oz. force
12"	1800	34.5 lbs.	69 lbs.
12"	2600	72 lbs.	144 lbs.
14"	1800	40 lbs.	80 lbs.
14"	2600	84 lbs.	168 lbs.

Thread varies according to type, twist, whether glazed or unglazed, size, strength, and treatment. Stitching varies according to number of stitches per inch, tension, and type: lock (locked at buff center) or chain. Lock stitching is stronger, whereas, chain stitching is less costly to apply. The thread used must be strong enough to do its job. The number of stitches per inch must be correct. In lock stitching, which uses a top and bottom thread, each must be sufficiently strong.

Other things being equal, wider buffs should reduce buffing costs as proportionate assembly cost, sewing cost, and center cost are reduced. Where the extra width is due to additional material content, the only additional cost is that of the material itself. Increased material usually results in increased buff life, when the buff is properly designed and fitted to the job.

Streaking is a problem frequently encountered in buffing, especially where the work has a non-cylindrical shape, and the buff is cut to conform to that shape. With this type of part, oscillating, or axial movement of the buff, or part, to avoid streaking is not always practical. Puckering and tapering are buff designs which eliminate streaking.

It is the responsibility of the buff manufacturer to supply the metal finisher with the latest information on buff design and utilization for specific purposes. A properly informed buffing department equipped with the right buffing tools for the individual job will effect economies through decreasing the number of rejects and achieve greater efficiency in turning out a better finished product.

Research

There has been a lack of published research in the field of polishing and buffing. However, Project No.

18 which covers the mechanical finishing of metal surfaces is being conducted, currently, by the A.E.S. In this project tests are being made with a standard specimen having a large flat area. A comparative reflectometer and an apparatus for scribing lines of known depth have been constructed, the buffing machine has been installed and is in operation, and a standard for the buffing compound has been established.

The following mechanical variables are being studied: buff speed, linear speed of the test piece, and frequency of buff oscillation. Buff variables to be studied include: cloth type, thread count, cloth weight, twist, cut fiber length, design, density, and size of the buffing wheel. The pressure between the wheel and the work piece, and the amount and kind of buffing compound are being varied.

Observations are being made on: temperature of workpiece, power required by the motor, rate of cut, reflectivity, hardness of the workpiece, and the presence of hard particles in the test specimen.

In addition to this research project, many others should be conducted. Other variables which might be studied are center design, buff treatment variations, balance conditions, use of spacers, types of metals, shapes of parts, square inches of area of part buffed, number of pieces in fixture, hand or automatic application of compound, bar versus liquid type compound, weight of compound per shot, length of break-in period, facing of cloth, fray and lint condition, direction of rotation of buff, direction of travel of the workpiece, and angle of buff to the part. Many research pitfalls are possible due partly, to the many variations.

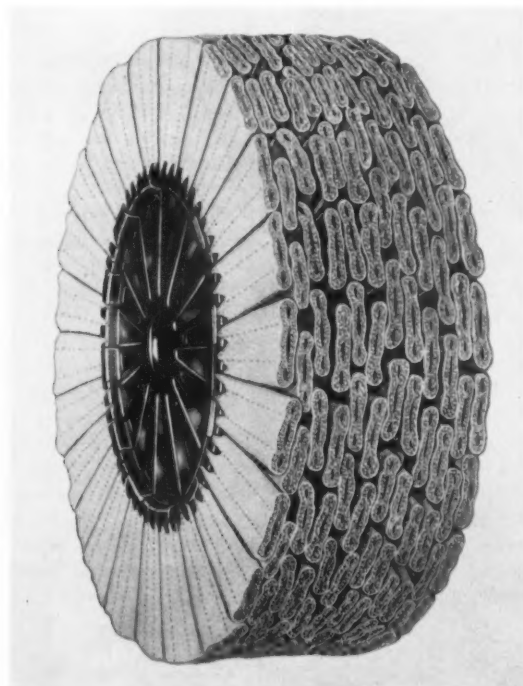


Fig. 8. Unit Sisal Wheel.

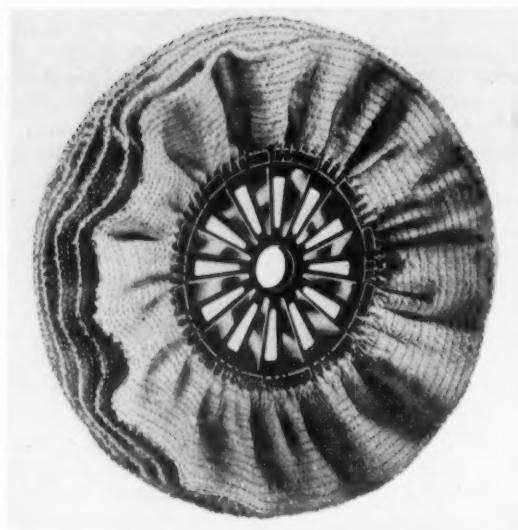


Fig. 9. Open Cloth Puckered Sisal (OCPs).

It is hoped that continuing research will be conducted. The buffing industry, in order to compete, must continue to outperform other methods of producing a bright, smooth surface. Research can lead the way to better buff design. And better buff design can result in better buffing.

SURFACE FINISHING STAINLESS STEEL

(Continued from page 53)

parallel. Herringbone scratches, gouges, grooves, and chatter marks can be averted by the use of proper technique.

5. Plan the finishing operations carefully so that metal removal will be gradual to the desired finish. In the event of spot polishing, it may be necessary to mask adjoining areas.

6. Suggested procedures have been given. However, it must be realized that experimental work may be required to determine those variables which exist in a specific shop. This would include not only procedures and breakdown of operations, but also, the evaluation of grits, lubricants, buff sections, wheel preparations, speed of operation, etc.

7. Do not attempt any short cuts. This is especially true where inexperienced operators are employed for finishing.

8. Do not hesitate to seek the advice of various vendors where aid can be obtained. Their knowledge is a composite of experience obtained in a large number of shops, which may be used for one's benefit in solving a specific problem. Their experimental data may be the answer to a problem.

9. When the desired finish has been obtained, the highly finished surface should be adequately protected from damage due to handling. One of the last operations of the finishing sequence is cleaning with a soft flannel cloth using a product such as whiting (pulverized calcium carbonate) or powdered chalk.

Institute of Metal Finishing

Annual Conference - Brighton 1959

By R. Pinner, Technical Editor, Electroplating and Metal Finishing, Teddington, England

THE 1959 Annual Conference of the Institute of Metal Finishing was held from April 8th to 11th in the Hotel Metropole, Brighton, Sussex, the premier seaside resort of the English South Coast.

Despite the fact that this year's conference was half a day shorter than in previous years, and that it took place only two months before the Detroit International Conference, the record attendance of upwards of 360 delegates included contingents not only from European countries such as Germany, France, Holland, Belgium, Italy, and Poland, but from as far distant as Australia and India. No doubt, due to the Detroit Conference, the representation from the United States was smaller than in other years, though Dr. Walter Meyer paid a welcome return visit to the Conference.

No less than 24 papers were presented, in spite of the shorter conference, almost twice as many as in preceding years. To some extent, this was facilitated by a new experiment in dealing with discussions, under which delegates were asked to present written discussion before the conference opened. These contributions were read in full or in summary form by the Session Chairman before throwing the meeting open to further discussion from the floor.



Left to right: H. Cann (W. Canning & Co. Ltd.); Dr. D. H. Garside (Principal, Borough Polytechnic; Hon. Treasurer I.M.F.); Dr. T. P. Hoar (Cambridge University, President I.M.F.); The Mayor of Brighton and Dr. S. Wernick (Hon. Secretary I.M.F.). In the background is R.A.F. Hammond (Past President I.M.F.).

ABSTRACTS OF PAPERS

The Production of Colored Anodic Films without the use of Dyestuffs

By J. M. Kape and E. C. Mills

An investigation into methods of obtaining color-anodized aluminum by inorganic pigments and sealing methods was described. Samples were anodized in sulfuric or oxalic acid at temperatures below 20°C. and colored at 20-40°C. in dye baths maintained at pH 4 to 8, with air agitation.

In outdoor exposure and accelerated weathering tests, it was found that the most durable and lightfast colors were obtained with the following pigments: (1) copper sulfide, a greenish-brown shade obtained by treatment in copper sulfate solution followed by 0.1% (vol.) conc. yellow ammonium sulfide solution, (2) ferric oxide, yellow-brown color, obtained by immersion in ferric ammonium oxalate solution or in ferrous ammonium sulfate solution, followed by potassium permanganate solution, (3) lead chromate, a yellow shade obtained by lead acetate solution, followed by potassium chromate solution, and (4) prussian blue shade which is sealed in dichromate.

The intensity of color and color-matching depends on close control of the anodizing conditions, and the authors found that the life of anodized architectural components may be lengthened considerably by regular monthly cleaning of the surface.

Anodized Aluminum Mirrors

By J. J. Dale, L. H. Esmore, and I. J. Howell

Mirrors for an automatic all-sky camera were produced from 99.99% aluminum blanks, which were machine polished with 48μ (coarse) and 0.2μ (fine) diamond abrasive powder in a triethanolamine stearate emulsion paste. The best results were obtained when the coarse and fine polishing stages were separated by electropolishing or anodizing, carried out to remove a layer of contaminated metal. Subsequent electropolishing in an 85% (vol.) phosphoric acid — 15% butyl alcohol mixture at 52°C., 12 v. for 5 min., gave a bright surface which was spoiled, however, by a marked ripple as well as by pits, spots, and a faint etch pattern. Better results were obtained when double anodizing and stripping were inserted before and after fine polishing, e.g., in a sequence: emulsion clean; rinse; trichlorethylene wash; hot rinse; alkaline clean (Na_3PO_4 —1 oz./gal., Na_2CO_3 —1 oz./gal., 5-10 sec., 45°C.); cold rinse; strip in boiling H_3PO_4 —3.5% CrO_3 —2%; rinse; anodize (H_2SO_4 —6% (vol.), 17-19°C., 6 amp./ft.², 14-16 v., 20 min. with pump circulation); spray rinse; strip (10 min.); anodize (20 min.); spray rinse; seal (boiling distilled water for 20 min.); clear in warm 40% (vol.) HNO_3 ; rinse; scrub with wet cotton wool; distilled water rinse; air dry.

An optical comparison method was described for deter-

mining ripple and other defects. While the mirrors fall short of aluminized glass and silver-rhodium plated brass mirrors, they are both cheaper and more durable. It was concluded that ripple would probably be less troublesome on smaller grain-size material.

Some Experimental Observations on the Effect of Addition Agents on Stress and Cracking in Rhodium Deposits

By F. H. Reid

An investigation into the effect of aluminum and magnesium sulfate and of selenic acid additions on the stress and cracking of rhodium deposits from sulfate electrolytes was described in this paper. Aluminum and magnesium additions were found to eliminate cracks in deposits up to at least 0.5 mil thick, but no corresponding reduction in tensile stress (40-50 ton/in.²) was observed in measurements on flexible strip cathodes. On the other hand, the addition of 1 g./l. selenic acid to electrolytes containing 50 ml./l. sulfuric acid resulted in deposits which, up to a thickness of 0.1 mil, showed many fine cracks penetrating to the basis metal, which tended to close up, however, with increasing thickness, and were not detected electrographically at thicknesses of between 0.2-0.5 mil.

The deflection of flexible strip cathodes indicates that internal stress is initially tensile, but becomes compressive and, finally, approaches zero after deposition of approximately 0.2 mil rhodium.

The selenic acid type of solution has the advantage over solutions containing aluminum or magnesium in respect to the deposit brightness, which is maintained even at considerable thicknesses (up to 2 mil), as well as in respect to stress in the presence of metallic impurities; e.g., addition of 1 g./l. copper enhanced the stress in deposits from aluminum and magnesium containing electrolytes, but had no marked effect on deposits from selenic acid electrolytes.

The improvement in protective value resulting from the use of selenic-acid modified electrolytes was demonstrated by plating copper rods with 0.5 mil rhodium from each solution and immersing in conc. nitric acid. After 25 min. the specimen from the unmodified solution was completely dissolved whilst the other remained unaffected.

Some Observations on Silver Anodes

By R. R. Benham

An investigation on the effect of grain size, anode current density, and impurities on the behaviour of silver anodes was reported. The main defects studied were flake formation and 'shedding' of anodes. Although flaking is avoided at anode current densities of over 50 amp./ft.², polarization makes the use of such high currents impracticable. The use of Nylon anode bags helped to minimize the effect, but led to depletion of silver in the solution. The author stated that, for best results, silver anodes should be of high purity and that annealed anodes give less trouble than work-hardened ones.

While increase in anode current density reduces the tendency to flaking, increase in silver concentration and temperature are detrimental. Organic impurities, e.g., from tank linings, may also cause flaking, and the trouble is more serious with large-grained than with small-grained anodes. The best anodes have small, regular and equiaxed grains, and these were found to give good results over a wide range of conditions.

Electroless Palladium Plating

By R. N. Rhoda

A process was described for the deposition by chemical reduction of palladium. The chemical reaction of this process is:

$$2\text{Pd}(\text{NH}_3)_4^{++} + \text{N}_2\text{H}_4 + 4\text{OH}^- \rightarrow 2\text{Pd} + 8\text{NH}_3 + \text{N}_2 + 4\text{H}_2\text{O}$$

and most metals, including palladium itself will catalyze this reaction.

The metal is present in the plating bath as an amine complex, e.g., tetramine palladium chloride. In addition to the hydrazine reducing agent, a stabilizing agent, e.g., the disodium salt of E.D.T.A., is also present.



Left to right: S. A. Watson (Mond Nickel Co. Ltd.); Dr. F. A. Champion (British Aluminium Co. Ltd.); Dr. L. L. Shreir (Conference Technical Sub-Committee Chairman); Dr. J. Edwards (British Non-Ferrous Metals Research Association); and Dr. U. Marx (Wilmot Breeden, Ltd.).

A typical solution for plating on nickel contains:

Palladium (complexed)	5.4 g./l.
Ammonium hydroxide	350 "
E.D.T.A. — Na ₂	33.6 "
Hydrazine	0.3 "

and this is used at 80°C. yielding a deposition rate of approx. 1 mil/hour.

An oblique plating barrel may be used for bulk plating at 35±5°C. in a solution containing: palladium 7.5 g./l., ammonium hydroxide 280 g./l., E.D.T.A. — Na₂ 8 g./l. In this case hydrazine is added at a rate of 8 ml. of a molar solution per hour per liter. The deposit consists of pure palladium in a ductile and adherent form. Hardness values from 150-350 KHN are obtained and deposits up to 2.5 mil thick have been plated. Suitable applications for the process are the plating of electrical connectors, pins and machine screw parts; carbon and graphite may also be plated, while deposits have been obtained on glass or plastic parts which have been sensitized.

Electrodeposition of Platinum from Chloroplatinic Acid

By R. H. Atkinson

The electrodeposition of platinum from solutions containing:

Chloroplatinic acid	15-25 g./l.
Hydrochloric acid	10-390 "

was investigated at 45-75°C. and at rates of deposition varying from 0.1-1.1 mil/hour, in order to find the best range within which ductile deposits are produced. Soluble platinum anodes were employed with and without the use of a diaphragm.

It was found that ductile deposits of hardness 155-250 KHN were plated at a minimum rate of deposition which varied with acidity from 0.7 mil/hour at 225 g./l. HCl to 0.35 mil/hour at 290 g./l. HCl. Deposits of 250-350 KHN, which were obtained at lower plating rates, were cracked or cracked when the deposit was rolled. At plating rates above 1 mil/hour, regardless of acidity, deposits became rough, spongy or semi-burnt. The electrolyte was found to possess good leveling properties and smooth deposits up to 13 mils could be plated. Heating the deposits above 1100°F. caused blistering.

Chloroplatinic acid was found to possess a hydrolysis pH of 2.2 but, due to the high acid content, the bath can only be used on noble metals.

The Properties of Bright Nickel Electrodeposits in Relation to the Period of Service of the Plating Bath. III. Composition and Microstructure.

By J. Edwards

In continuation of the work carried out on the effect of aging of bright nickel baths (for Parts I and II c.f. Trans. Inst. Met. Finishing, 1958, 35, Adv. Copy No. 3), the carbon, oxygen, hydrogen and nitrogen contents of deposits obtained

from two proprietary solutions were determined by chemical analysis.

The amount of organic material in the deposit was found to increase with the age of the plating bath and, for both types of bright nickel, a relationship was found between the ductility and the amount of organic material included in the deposit. Periodic addition of proprietary anti-stress agent to one of the baths not only lowered the tensile stress and increased the ductility, but was found to reduce the total amount of organic material in the deposit.

Nickel Plating by Thermolysis of Nickel Carbonyl Vapor

By L. W. Owen

In thermolysis or gas plating, a volatile compound of the metal is decomposed on the heated object. Principal applications are for metals, i.e. molybdenum, tungsten, tantalum, niobium, beryllium, titanium, zirconium, and vanadium. Although the deposition of nickel is less attractive for most purposes, sound coatings comparable with electrodeposited nickel can be deposited on, e.g., magnesium and uranium, or on porous metal compacts.

Two processes are in use: (i) the low pressure method in which the work is heated by induction or infra-red on a stand in an evacuated metal-glass plating chamber. At 210-230°C. the vacuum system is isolated and nickel carbonyl vapor, with or without carbon monoxide, is fed in at controlled pressure, reversing the flow of vapor after a time in order to produce even coating thickness. The decomposition efficiency is around 80%, the undecomposed vapor being removed by a thermal trap. (ii) in the atmospheric pressure method the vapor is 'dissolved' in air-free carbon monoxide carrier gas. This process involves more practical problems but has greater flexibility in size and shape of chamber and rate of deposition.

The principal variables are temperature, rate of flow and total pressure. There are advantages in plating at below 3 mm. or at slightly below atmospheric pressures. If the temperature is too low, a fissured surface and a brittle coating are produced. The hardness of the nickel is around 200 D.P.N. The higher the hardness the lower, in general, the ductility. Porosity is comparable with electrodeposited nickel, varying directly with thickness. While the adhesion to copper is extremely good, other metals require a short heat treatment to improve the bond.

Rapid Quantitative Methods for the Determination of Brightness, Levelers, and Anti-Pitting Agents in Nickel Electroplating Baths

By K. Szmidt, T. Zak and Zb. Kwiatkowski

Polarographic and other physicochemical methods for determining addition agent concentrations in nickel baths were investigated. A radiometer polarograph was used at 25°C. ($\pm 0.1^\circ$), while surface tension was measured by the maximum bubble pressure method.

Cadmium was determined by direct polarography in 5 ml. samples at pH 4.8-5.0. Cadmium waves appear at about -0.43v (to the Hg anode).

In the absence of a wetting agent, p-toluene sulphonamide was determined in a 7 ml. sample in 50 ml. 0.2N potassium chloride solution. The oxygen maximum was obtained at 70 mm and the polarogram started at -0.15v. In the absence of brightener, sulphonated isopropyl-naphthalene wetting agent was determined in the same way as p-toluene sulphonamide, which the maximum bubble pressure surface tension method can also be used. When both organic compounds are present in the bath the wetting agent concentration is obtained by the surface tension method and the p-toluene sulphonamide content by interpolation from the percentage lowering of the oxygen maximum.

Electrodeposition of Copper-Nickel Alloys from Citrate Solutions

By B. H. Priscott

Experiments with published plating solutions for copper-nickel deposits showed that the best results were obtained with citrate baths. A solution investigated contained:

Nickel sulfate	42 g./l.
Copper sulfate	10.3 "
Sodium citrate	75 "
Sodium chloride	2 "

The optimum conditions were achieved when the total metal concentration (as sulfates) was 0.19 M, at pH 5, 20 amp./ft.² and 55°C. The presence of chloride is required to promote anode corrosion and, under the conditions given, 50% copper — 50% nickel deposits were obtained. Anode efficiencies were approx. 96% and cathode efficiencies approx. 76%.

The copper/nickel ratio of the deposit is approximately twice that of the solution. While increase in temperature had little effect on the deposit composition, it caused an increase in cathode efficiency. Increasing rate of agitation raised, and increasing current density reduced, the copper content, in the last case accompanied by a drop in cathode efficiency. The throwing power of the alloy bath was found to be markedly greater than that of a Watts nickel bath.

The deposits had a similar appearance to wrought alloys of the same composition and were a dull mat. The hardness of a 75% copper alloy was between 200 and 260 D.P.N. Contractile stress in a 0.3 mil deposit was approx. 30,000 p.s.i.

Bronze Plating from Modified Stannate Cyanide Baths

By W. T. Lee

A plating bath for depositing 10-12% tin bronze was described in this paper. The bath contains copper, 25 g./l.; tin 12 g./l.; free cyanide 17 g./l.; free caustic soda 1 g./l.; and is used with a proprietary addition agent, and with 90% Cu - 10% Sn cast anodes. The copper/tin content of the bath determines the composition, and hence the color, of the deposit. Increase of the free cyanide and caustic soda concentrations and raising the temperature favor a tin-rich deposit while, as the current density increases, the copper content goes through a minimum. The cathode efficiency drops with current density and with the age of the solution, but a plating rate of 2 mil/hour can be maintained by raising the initial current density of 30 amp./ft.² as the age of the bath increases.

Rise in carbonate causes a reduction in anode efficiency, which can be counteracted by solution agitation. Traces of stannite may also be formed. These cause roughness and are removed by hydrogen peroxide. The throwing power of the bath is exceptionally good, and coatings are non-porous above 0.3 mil thickness. Hardness of the deposit varies with the composition, e.g., it is 314 D.P.N. on 84% Cu — 16% Sn, 283 D.P.N. at 91.8% Cu — 8.2% Sn and 199 D.P.N. at 95.2% Cu — 4.8% Sn deposits.

Potassium-based baths are not used widely in Britain, although they have higher cathode and anode efficiencies. A lithium-based solution, which is in the development stage, has also given good results.

The Properties of Nickel Electrodeposited from a Sulphamate Bath

By D. A. Fanner and R. A. F. Hammond

The properties of nickel deposited from a solution containing:

Nickel sulphamate	350 g./l.
Nickel chloride (cryst.)	3.3 "
Boric acid	30 "

were investigated. It was shown that minimum stress was obtained at pH 4.0, 50°C. and 20-60 amp./ft.². Apart from the stress, the properties of deposits and the effect of operating conditions were as for the Watts bath. The improvement in fatigue strength, however, was marginal and a tendency to pitting was observed in the absence of wetting agent. The high deposition rate and low stress of sulphamate nickel deposits make the process particularly suitable for electro-forming.

The Analysis of Nickel Sulphamate Plating Solutions

By G. H. Bush and D. G. Higgs

Methods of analysis for the nickel sulphamate plating solutions were described.

Total nitrogen. Dilute a 10 ml. sample to 200 ml. Transfer

20 ml. to a 150 ml. Kjeldahl flask. Add 10 gr. K_2SO_4 and 10 ml. conc. H_2SO_4 . Heat 15 min. after fumes appear. Cool, add 50 ml. water, heat to dissolve crystals and transfer to the distilling apparatus with 50 ml. water. Add 10 ml. 50% tartaric acid, 50 ml. 40% NaOH and wash down with 50 ml. water. Pass steam in and collect the distillate in 50 ml. 0.1N H_2SO_4 containing 2 drops of methyl red. Distill for 15 minutes after the condensate appears. Back-titrate 0.1N NaOH and carry out a blank. (1 ml. 0.1N H_2SO_4 = 0.01254 g. nickel sulphamate.)

Ammonium Ion. Add 50 ml. solution containing 5 ml. plating solution to the distilling apparatus. Add 10 ml. 50% tartaric acid, 50 ml. 40% NaOH and 100 ml. water. Heat and collect the distillate in a measured volume of 0.1N H_2SO_4 using 2 drops methyl red. Back-titrate with 0.1N sodium hydroxide, (1 ml. 0.1N H_2SO_4 = 0.0017g. NH_3).

Nickel. Dilute a 10 ml. sample to 100 ml. to a 5 ml. aliquot in a beaker, add 150 ml. water and 2 ml. buffer solution (33 g. NH_4Cl , 285 ml. NH_4OH , (diluted to 500 ml.) to pH 10-11. Add 4 drops 0.1% murexide indicator in 1% NaOH, stir magnetically and titrate with standardized 75 g./l. E.D.T.A. solution with the 5 ml. burette tip below the solution (blue to red). (1 ml. 0.2N E.D.T.A. = 0.05116 g. nickel sulphamate.)

Boric Acid. Dilute a 5 ml. sample in the top of a 20 cm. x 2 cm. ion exchange column containing 14 g. IR — 120 resin with 10 ml. water, pass through the column at 8-10 ml./min. and wash with 4 bed vol. water into a 300 ml. flask. Add 2 drops 0.2% p-nitrophenol, neutralize with 20% NaOH, acidify with 2% H_2SO_4 , and add 3 more drops. Reflux in a water cooled condenser to expel CO_2 and cool. Wash into the flask and add carbonate-free 0.1N NaOH to a faint yellow. Add 5 g. mannitol, 6 drops 1% phenolphthalein in 50% ethanol and titrate to the pink end point. (1 ml. 0.1N sodium hydroxide = 0.006184 g. boric acid.)

Naphthalene 1:3:6 Trisulphonic Acid. Measure the optical density of a 250 times diluted sample by a spectrophotometer in 10 mm. silica cells at 280 m μ and 0.3 mm. slit width. A calibration curve is used.

Chloride. Treat a diluted 10 ml. sample in an ion-exchange column with IR — 120 resin (H form) as for boric acid. To the eluate in a 300 ml. flask add 1 ml. dil. HNO_3 , 20 ml. amyl alcohol and 1 ml. 10% ferric alum solution (acidified with HNO_3) and add 0.1N $AgNO_3$ (a 5 ml. excess). Titrate with 0.1N NH_4SCN to reddish brown. (1 ml. 0.1N silver nitrate = 0.003546 g. chlorine.)

The Brittle Fracture of Ultra-High Tensile Steels in Relation to Surface Coatings

By R. L. Samuel and N. A. Lockington

Newly developed steels with tensile strength of up to 150 tons p.s.i. fail by brittle fracture under constant load, well below their nominal ultimate strength, an effect which is usually attributed to hydrogen embrittlement. This paper describes a program of tests on small specimens (tensometer No. 12), of ultra-high tensile steel, notched in their center, which were subjected to constant stress in specially designed jigs. Various types of electrolytic or vapor-deposited coatings were applied to the specimens. It was concluded that, with stresses of the order of 80% of fracture strength, cadmium plated specimens generally fail in 10-100 hr. in the absence of corrosion, while zinc vapor-coated specimens do not appear to be sensitive to delayed fracture. Nickel-chromium plated specimens give inconsistent results, while nickel-plating usually behaves in much the same way as zinc vapor-coated specimens.

Under 3% salt spray, rapid failure of uncoated and coated specimens takes place at stresses of approximately 70% of the notched fracture strength. Of the metal coatings, cadmium-plated specimens were most sensitive, nickel-plated specimens the most resistant; a hard silicone lacquer showed the best results. There is evidence that failure is related to the mechanism of corrosion reaction rather than to the extent of corrosion. Thus, other corrosive agents, such as tap water or solutions of ammonium carbonate, do not cause this accelerated failure even if severe corrosion takes place.

Hydrogen Embrittlement of Steel by Cathode Charging, Pickling and Cadmium Plating

By K. Sachs and S. H. Melbourne

The effects of electrolytic cathode charging and subsequent aging at various temperatures on the ductility of mild steel screw wire were investigated, and the embrittlement resulting from hydrogen absorption in routine plating operations was studied on slugs cut from wire and on carbon steel coil springs. Batches were processed in the plants and representative samples were withdrawn for testing at various stages. The operations considered were pickling, storage in cyanide solution, cadmium plating, hot air centrifuge drying, and baking.

The screw wire slugs were most severely embrittled by pickling and recovered ductility to some extent during plating. The springs, on the other hand, were even more brittle after plating than after pickling. The springs showed considerably more scatter in plating thickness, and there is evidence that the variability of embrittlement is also greater. The slugs showed more consistent results within a barrel load, probably because their shape favors smooth and regular tumbling in the barrel. Differences between batches were studied only with slugs and were found to be much greater than the scatter within a batch. It was concluded that the relative importance of pickling and plating varies with different specimens, e.g., according to the cross-section of steel, the pickling time, and the composition and heat treatment of the steel. Routine processing can produce a degree of embrittlement varying over a wide range. In screw wire slugs, embrittlement was very sensitive to the duration of the pickling treatment. Variations in pickling time of only $\frac{1}{2}$ min. led to very profound changes in the ductility of the wire.

Thinner sections, higher carbon content, cold work, and higher mechanical strength, tends to make components more sensitive to hydrogen embrittlement. Components of complex shape, which do not tumble smoothly in a barrel and do not offer a low-resistance path to current passing from the cathode contact, will vary widely in ductility and plate thickness after processing. Embrittled, plated specimens recover on aging at a slower rate than specimens that have been embrittled by cathode charging only.

Hardness of Electrodeposited Speculum and Other Tin-Copper Alloys

By V. R. Ramanathan

The hardness of copper-tin alloys deposited from the copper cyanide-sodium stannate bath was investigated under various operating conditions.

It was found that speculum had the highest hardness (D.P.H. 520 ± 9) at around 38.4% tin, corresponding to the intermetallic composition Cu_3Sn , though X-ray examination also shows the presence of a little Cu_6Sn_5 . Hardness was found to be independent of the coating thickness. In micro hardness testing, if the deposit is softer than the base, the hardness remains relatively unaffected by the latter until almost the whole thickness has been penetrated. Vice versa, the hardness value is effected after penetration of $\frac{1}{4}$ of the thickness. The hardness of copper 90% — tin 10% alloy was about 280 D.P.H.

Structure and Growth of Iron and Chromium Electrodeposits on Copper Single-Crystal Faces

By A. K. N. Reddy and H. Wilman

The structure and growth of iron electrodeposits on smooth electropolished copper (110), (100) and (111) single-crystal faces, were investigated by electron diffraction and, as the authors pointed out, this was the first study in such detail, for a body-centered cubic metal deposited onto a face-centered cubic metal crystal, over a wide range of thickness and current density. The effects of temperature and co-deposition of $Fe(OH)_2$ were also shown.

Four main stages of growth of the iron were distinguished, characterized by a predominant type of crystal orientation: (1) epitaxial (two-degree) orientation with a $\langle 111 \rangle$ Fe atom row along a Cu $\langle 110 \rangle$ row in all cases, and with a (211), (110) and (110) plane respectively parallel to the Cu (110), (100) and (111) surfaces; 2) as (1) but with

211) twinning; (3) either a wide range of orientations or random-polycrystalline structure; (4) development of a one-degree $\langle 111 \rangle$ orientation (strongly "outward growth"). The twinning was developed, in deposits of a given thickness, above a critical current density which appeared to be lower on Cu (111) than on (100) and (110). One-sided rotational displacements from these orientations were observed (a new phenomenon) about Fe $\langle 110 \rangle$ axes in the deposits on Cu (110), and Fe $\langle 111 \rangle$ in the Fe on the Cu (100) face. This is probably a result of stress due to lattice misfit.

Chromium deposits on these Cu faces at 45°C., developed the same epitaxial orientations and rotational disorientation as for iron.

An Electrochemical Method of Obtaining an Index of Porosity of Metal Coatings

By M. Clarke and S. C. Britton

A new electrochemical method for testing porosity of metal coatings was described. This consists of making the metal anodic in 3% NaCl solution. If the potential of a nickel, tin-nickel, copper, or speculum coating on steel is displaced by not more than 100 mv, the current is passed almost entirely by the basis metal at the pores. The method is applicable to tin-nickel coatings on copper and nickel while, for testing tin coatings, a 20 g./l. NH_4SCN , 50 ml/l. H_2O_2 (20 vol.) solution is suitable. The displacement of the potential during the test varies linearly with the applied current density, and the gradient of the current-potential curve varies with the conductivity of the electrolyte and is believed to represent its resistance in the pore channels. It was found that pores are neither created nor enlarged by the new method, and 0.1% Rochelle salt may be added to prevent an increase of apparent resistance on repeated tests of one panel.

The ratio of shift of potential to applied current density is taken as a porosity index which depends on the number, area, length, and shape of the pores. The method was put forward as a research tool rather than for routine porosity testing.

Optical Methods of Studying Surface Finish

By O. S. Heavens

Five optical methods for the study of surface finish of polished or electrodeposited metal were discussed.

Straight microscopy. Dark field illumination and phase contrast methods are often particularly useful. The method is used to examine growth features and slip-bands.

Interference Microscopy. Suitable for surfaces of reasonable optical smoothness; the two-beam interference microscope shows up surface roughness as an irregularity in the fringe system. It has been applied to the study of leveling.

Light Profile Microscopy. This method, suitable for rougher surfaces, consists of projecting the image of a narrow slit or fine wire onto the surface at an oblique angle. Irregularities of down to 0.5 microinch may be detected.

Multiple-beam Interferometry. This method requires a very smooth surface, on which it yields high resolution in a direction normal to the surface. Interference is produced between the test surface and a silver coated reference surface, and the method has been applied to film thickness and hardness testing, and to the study of crystal growth.

Reflectivity Measurement. This requires a few sq. mm. of flat surface. Specular reflectance has been used for studying the surface finish of electrodeposits. The ratio of specular/diffuse reflectance can be used as a measure of surface roughness and has been applied to hardness testing.

Multiple-beam interference and refractive index measurements have been applied to the study of anodic oxide films on new metals such as tantalum.

Some Techniques in the Study of the Rate of Deposition and Formation of Inorganic Films on Metal Surfaces

By H. R. Thirsk and W. F. K. Wynne-Jones

Little is yet known concerning the kinetics of the electro-deposition process. Ion values apparently are often large, and this would imply that a.c. rather than d.c. methods would best be employed; nevertheless, few such studies have been

made. Under d.c. conditions, difficulties of separating concentration and ohmic overpotential from total overpotential are considerable. Furthermore, the 'effective' area tends to change during deposition, the metal apparently depositing on active spots on the surface, and the activity of these same regions may change with time.

Following the work of Erdey-Gruz, Volmer, and others, opinion concerning the mechanism of deposition in 1935 and 1937 after the extensive work fell then under two headings; that (a) deposition occurred in two stages, first the discharge of the metal ion and secondly the falling into the lattice, (b) neutralization and deposition were simultaneous. Since the metal in the lattice is certainly an ion, this first process would more properly be regarded as an ionic transfer from a solvation sheath in the Helmholtz layer to the metal plane; it seems incorrect to liken it to an electron transfer process and, certainly, the ion is not discharged. The implication of the discussions is however clear. We are confronted by a difficult problem in the kinetics of crystallization, as well as the more purely electrochemical aspect of the process, that is, the transference of the ion or ion complex across the double layer in the presence or absence of adsorbed substances, and the isolation of the metal ion in a position from which it may move into the lattice.

Recent experimental and theoretical methods and speculations are discussed, and suggestions are made concerning alternative technique. It is thought that it should be possible to isolate the processes of nucleation and subsequent growth in the deposition and observe the potential dependence of the related kinetic constants and the effect of concentration, organic additives, anions, etc. The methods are illustrated from anodic studies.

An Apparatus for the Continuous Measurement of Dissolution of Metals

By T. S. Gromoboy and L. L. Shreier

An apparatus was described for the measurement of the rate of dissolution of a metal without interrupting the process, and its application was discussed to the study of chemical polishing of aluminum. The metal is used in the form of a thin wire, which is wound non-inductively round a glass rod which can be rotated at constant measured speeds. A.c. is passed through the wire and the potential is measured. The electrical resistance and, hence, the radius of the wire are then calculated from $r = K/\sqrt{\Omega_1}$ where Ω_1 is the resistance of the wire immersed in the acid, $K = \rho l/\sqrt{\Omega}$, ρ is the specific resistance of the metal and l the increased length. Some results were obtained for the rate of dissolution of aluminum in a solution containing phosphoric acid 75% (vol.), nitric acid 5%, water 20%. An initial induction period before dissolution commenced became more pronounced the lower the temperature. The method was found to give good reproducibility with direct loss of weight measurement.

Developments in Metal Pre-Treatment

By R. E. Shaw

In this paper the author described advances in the field of metal pretreatment, with particular reference to the preparation of metals for painting.

The cost of heating spray plants can now be reduced by the use of cleaners and phosphating solutions which operate at low temperatures. For dip installations a new surface layer technique reduces heating costs by 75% or more.

The special requirements of one-coat finishes and acrylic paints can be met by thin, smooth phosphate coatings. Recent work has shown that phosphate coating refinement can be obtained by modification of the processing solutions with polyphosphates or inhibitors. Details of the peroxide-accelerated zinc phosphate process are given with particular reference to the car industry. The use of thin iron phosphate coatings for strip steel and other applications is described. New control methods and improved plant designs prevent rinse water blistering of paint in large installations, and a solvent drying process is now available for the immersion treatment of plated or phosphated articles to eliminate water marks and rinse water contamination.

Alkaline derusting processes find particular application for

the treatment of high tensile steels to avoid hydrogen embrittlement and for components which must not be subjected to any loss of metal.

On aluminum, chromate-phosphate treatments are in wide use for paint pretreatment, as well as for producing decorative green coatings. Chromic/nitric/fluoride room temperature treatment is used to give a golden yellow film for corrosion protection in the aircraft industry.

Rapid phosphate and chromate treatments are now widely used on electrolytic tin-zinc coated steel to prevent corrosion and to improve paint adhesion.

The invisible chromate films are used to prevent the deterioration of bright hot dipped zinc coatings in transit and storage.

The Measurement of Industrial Paint Finishing Costs

By H. H. Norcross

The chief task of the accountant in industry is to provide figures and advise on them to those responsible for the practical operation of running industry. In paint shops such information should include the expenditure on paint, labor and overhead, and also how such expenditure compares with a budget predetermined from standards of painting regarding appearance and protection.

The control of overhead in paint shops should be through budgetary control. For each item a budget is set showing the allowable expenditure. Actual output may, however, be greater or less than was anticipated, in which case the basic expense allowance will not be appropriate. Where this is so, it is desirable for the budget to be set on a flexible basis. For each item, there will be laid down what the expense ought to be for the budgeted level of output and this may be made more flexible by laying down a basis on which the allowance is raised or lowered according to whether the output is greater or less than the budget.

For each item of expense and for the shop as a whole, a monthly statement should show (a) the basic budget, (b) the adjusted budget, i.e. the expense allowance for the level of output actually achieved, (c) actual expenditure, and (d) the extent to which the latter is above or below the adjusted budget.

Wide expenditure on capital equipment for a paint shop can be a very profitable investment and, in the control of such expenditure, the industrial accountant has a part to play. To control capital expenditure, each project is examined to see what benefits or cost reductions are to be expected. In deciding priorities for projects requiring capital expenditure, the time a project will take to pay for itself is a main factor.

Recent Advances in Plastic Coating for Metals

By D. E. J. Cunningham

This paper described the current commercial practice in applying homogenous plastic coatings to metals for protection and decoration. Four methods were dealt with, including (1) powder spraying, (2) powder dipping, (3) flame spraying, and (4) the solution or dispersion method.

The surface preparation of steel consists of alkali or solvent degreasing followed by shotblasting with angular steel grit at a 60 to 100 psi. air pressure, to remove rust and scale and also to provide the necessary key to obtain good adhesion.

Equipment for the deposition of dry thermoplastic powders onto heated surfaces includes powder feeders and containers, metalizing guns modified for use with plastic powders, ovens, and fluidizing tanks for the dipping method.

Plastic coatings are inspected for appearance, adhesion and continuity. Adhesion tests are all destructive, but electrical tests for continuity are made on every article in a jobbing works or samples in batches from automatic plant.

FINISHING POINTERS

PLATING ON INCONEL

By Ed Calderon, San Diego, Calif.

IN plating on Inconel, Inconel-X, and similar alloys containing nickel, cobalt, and chromium, plus small amounts of other metals, difficulty is sometimes encountered in obtaining satisfactory adhesion. This is particularly true when high-temperature applications are encountered. Although the usual method of ensuring deposit adhesion on these alloys involves employment of a nickel chloride strike, the author's company requested development of a method for silver plating directly on Inconel-X turnbuckles, which were to be operated at a constant temperature somewhat below the melting point of silver (1700°F.). The object of silver plating was to prevent galling and seizing of the threaded portions of the turnbuckles. The basis metal, having a high nickel content (73%), tends to form a tenacious, passive surface film, not always removable by the standard treatments. However, using the process detailed below, many thousands of these turnbuckles were processed in the author's laboratory without a single reject.

Conditioning Procedure

The parts are pickled free from scale, or are tumbled

with abrasive, then racked and degreased in a vapor degreaser, in the usual manner. They are then soak cleaned in a heavy duty proprietary alkaline soak cleaner for ferrous alloys, at about 190-210°F. for 10 minutes, and thoroughly rinsed in clean cold water. This is followed by wet scratch brushing, using a nickel-silver wire brush and FFFF pumice, after which the parts are again rinsed, preferably with a spray. Next, the parts are electrocleaned cathodically, at 6 volts and at a temperature of 190-210°F., in a clean heavy duty proprietary electrocleaner, for a period of 30 seconds, followed by a thorough rinse in cold running water. Being completely soil-free, the surface is then ready for activation.

The first activation step is to treat cathodically in concentrated hydrochloric acid for 30 seconds at room temperature and 10 volts, using carbon anodes. The tank must be of glass or rubber or plastic-lined, lead or stainless steel being unsuitable. Adequate ventilation is necessary since the fumes are quite heavy and corrosive. Mild agitation during this etching period is advantageous in accelerating removal of the film, which is principally nickel oxide. The etching treatment is followed by quick rinsing in cold water.

Without delay, the work is now immersed in concentrated fluoboric acid (42% HBF₄). A potential of 10 volts is applied for 30 seconds at room temperature, with the work cathodic, and using carbon anodes again. Tank material is the same as for the hydrochloric acid treatment, and ventilation is also required here, as is gentle agitation. After quickly rinsing in

(Continued on page 69)

Science for the Coatings Technologist

Part XIII. Additives: Stabilizers

By E. S. Beck

This is the second and final part of a two part article describing stabilizers. The first part appeared in our May issue.—Ed.

THIS is a very large and very important group of materials. We have up to now discussed stabilizers for the liquid paint. It is true that if the fluid is not kept in a usable state until the paint is applied, further properties are of no importance. However, the condition of the liquid paint ceases to have significance once it is applied. The properties of the film then become all-important.

There are a number of valuable coatings resins which could not be used at all, were it not for the stabilizers which are a part of the formulation. And a further number of resins would have only the most limited usefulness without their stabilizers.

Many of the synthetic elastomeric materials are in the group of products for which stabilization is essential. These include chlorinated rubber, Neoprene, Hypalon, and polyvinyl chloride. It so happens that these are among the most valuable and most useful of the elastomeric resins. It may be stretching things a bit to include chlorinated rubber in this class, for the elastomer is so highly modified that most of the rubberiness and elasticity are removed. However, from the point of view of composition as well as handling properties, it belongs here more than anywhere else.

Chlorinated rubber, when formulated into a paint composition, possesses many valuable properties, including speed of dry, chemical resistance and durability. However, as it is highly chlorinated, the problem of decomposition is always present. Chalking and color change on exposure can be sharply reduced by the use of proper stabilizers. For opaque coatings, dibasic lead phosphite is very good. Addition of 5 to 10 per cent of this material will make a great improvement in the light stability of the composition.

Other acid-accepting compounds can also be used, such as epoxidized oil plasticizers, white lead, etc. but the material seems almost unique in its beneficial properties, and this is the stabilizer of choice. Unlike many other stabilizers, it is a material which must be ground into the vehicle, but since it is used only with pigmented coatings, this is no real drawback.

Occasionally it is necessary to bake chlorinated

rubber finishes at temperatures of 250 to 300°F. The material is unstable at these temperatures, and heat decomposition will occur. A number of substances are available for stabilization. Compatible types of melamines and ureas are of value for this purpose. Most useful are epoxy resins, where compatibility with the chlorinated rubber can be obtained. Acid-absorbing materials are of some value, as is dibasic lead phosphite. As the temperature of baking is increased, the difficulty of stabilizing becomes greater.

Clear chlorinated rubber finishes can be stabilized with epoxy resins, epoxidized oil esters, and with acrylic resins. The function of acrylics in this connection seems to be unique. If the stabilized type of chlorinated rubber is used to start with, about 25% of acrylic resin or an equal quantity of epoxidized oil ester will do a very acceptable job. The function of the acrylic resin may be called unique because it has no stabilizing power in the ordinary sense, and is not an acid scavenging material.

Neoprenes and Hypalons

Neoprenes are exceptionally durable materials. Properly formulated into a coating, they yield what may be the most durable of all protective coatings on outdoor exposure. It seems far-fetched to think of any need for stabilizing such materials. Yet they are chlorinated products (polychloroprene) and under the proper circumstances they will decompose with the liberation of hydrochloric acid. Stabilizers can overcome this tendency almost entirely.

It is not practical to make neoprene finishes in the clear state because of this tendency to break down on exposure to sunlight and air. The choice of the proper opaque pigments is almost all that need be done to accomplish a full measure of stabilization. Black, red iron oxide, aluminum, and other dark pigments will shield the neoprene from light. White is not a practical color for neoprene, and some yellowing will become evident. There is enough shielding action to avoid a bad breakdown of the neoprene, however.

Additional stabilization can be achieved by the use of zinc oxide in amounts about 5%. This especially confers improved heat resistance on the formulation. Some neoprene formulas use zinc and magnesium

oxides as catalysts for vulcanization. Additional amounts of zinc oxide, over that needed for the cure, can be used for the supplemental stabilizing. Some anti-oxidants, in small amounts, are occasionally used to reduce the tendency to oxidize on exposure. It is debatable, however, to what extent they improve long-term durability.

Hypalon is a coating material possibly even more durable than neoprene. It is definitely superior in resistance to ozone. Its tendency to breakdown on exposure to light is less than that of neoprene, and white and light colors can be made with good stability. However, it too is a chlorinated polymer, and shows a certain tendency toward breakdown on exposure. It is not suitable for use in clear finishes for this reason.

Hypalon is readily stabilized with opaque pigments, even titanium dioxide. It may be vulcanized with tribasic lead maleate and derives a measure of additional stability from the presence of this stabilizer. Other stabilizers are also used for the preservation of viscosity and flow characteristics. These are fatty acids and rosin esters. They do not contribute anything much to the final film properties or Hypalon compositions.

Polyvinyl Chloride

We have now arrived at the coating material which is more dependent on stabilizer than any of the other commonly used resins. If appropriate stabilizers were not available, it is doubtful whether polyvinyl chloride could have achieved its extremely wide usage. And the number of stabilizers which have been developed for this resin is almost legion. There are so many different aspects to the problem, and so many different points of emphasis, that there is a need and a justification for each type of stabilizer.

The importance of polyvinyl chloride justifies detailed attention to the problems of stabilizing it. It has rapidly become one of the major plastics ma-

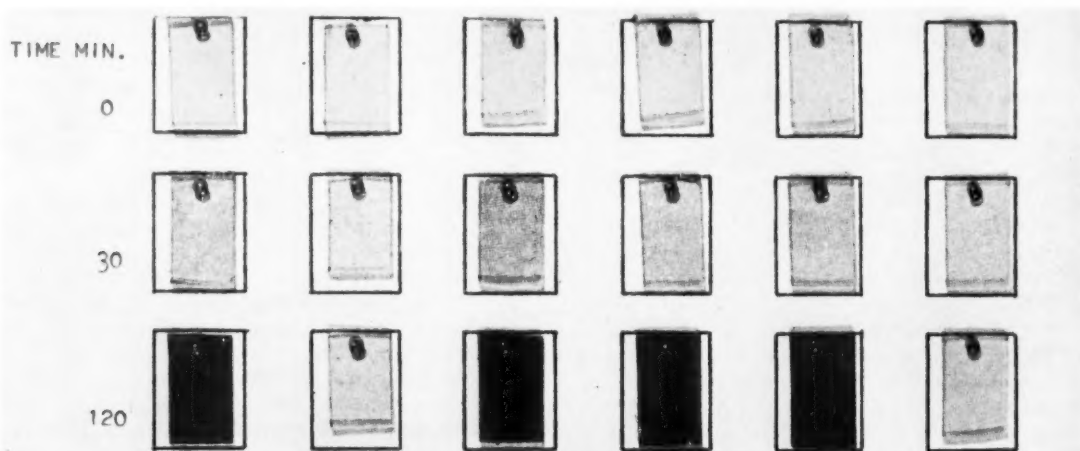
terials; and its valuable properties make it extremely useful as a coating resin. In the form of solutions (both straight polyvinyl chloride and copolymers with vinyl acetate and other materials) and dispersions (plastisols and organosols) it is a major coatings ingredient.

There seems little doubt that its importance will continue to grow in the coatings field as users learn its good properties and paint manufacturers develop the know-how to handle it efficiently. The gradual decline in the price of the resin has greatly helped in increasing its use. The cost today is no higher than many of the conventional coatings materials now in use which do not possess the toughness and chemical resistance of polyvinyl chloride. On this basis alone, it would be reasonable to assume that the proportion of coatings based on polyvinyl chloride is destined to increase steadily.

In another place in this series we will consider the properties of polyvinyl chloride as a coating material. At this point, we want to concentrate on the question of its stabilization.

The stabilization is actually a matter of protection against a number of different things. The two major factors are heat stabilization and light stabilization. Secondary are oxidation, and such accessory things as exudation stabilization. It is not possible to find a stabilizer for polyvinyl chloride which will be outstanding in all respects. Each material has its special good and weak points. The selection is on the basis of which properties are most appropriate to the formulation at hand.

Even such things as the type of plasticizer and the pigment color play a part in the choice of stabilizer. This is because there is a certain measure of interaction between these components and the stabilizer chosen. The question of the end-use of the coating must also be considered because some stabilizers discolor badly on exposure to sulfide while others do not. If sulfide pigments are present in the coating,



(Courtesy Advance Solvents and Chemicals)

Fig. 3. Heat Stability of Polyvinyl Chloride Formulations at 320 degrees F.

Five different stabilizers are under test in this experiment. The first column at the left contains no stabilizer. The second uses an organo-tin stabilizer; and the fifth a cadmium stabilizer. As these are clear films, lead stabilizers would be unsuitable.

or if the exposure life of the coating may include exposure to sulfide fumes (as from the combination of soft coal or sour crude oil or industrial fumes in general) this type of discoloration becomes very important.

Clear films require one type of stabilizer, pigmented ones another. Add to all this the fact that the costs of stabilizing materials vary widely, and it is apparent that the basis of selection is somewhat complicated. In fact, most polyvinyl chloride compositions are stabilized with a mixture of materials, sometimes as many as five or six.

We will consider only the stabilization of polyvinyl chloride plastisols or organosols. The same principles will apply to copolymer solutions, which are simpler in every way. While there are a number of types of stabilizers in common use, they can be grouped into four classes:

1. Lead salts
2. Other metallic compounds
3. Epoxy compounds
4. Other organic compounds.

Lead Salts

Lead salts (or soaps) were among the first vinyl stabilizers to be used. They are extremely efficient in hydrochloric acid acceptance, and are low in cost, relatively speaking. They are effective as both light and heat stabilizers. Lead, upon reacting with hydrochloric acid forms an insoluble chloride, thereby effectively removing the hydrochloric acid from the system.

However, lead compounds also have some disadvantages. Lead is a toxic material. There are many applications where its presence would be objectionable. Coatings for food containers, or children's toys, for instance. It also tends to yellow, sooner or later, by reaction with sulfur in the air. If sulfur-containing resins or plasticizers are used in the formula, lead stabilizers had better be forgone.

Lead compounds are opaque, hence unsuitable for use in clear formulations. Certain lead compounds can be used in some applications where maximum transparency is not required.

Amounts used will vary, naturally, but an average value would be from 3-10% based on the compound selected and the formulation. Many types of lead stabilizers are available, including litharge (useful only for dark formulations as it discolors very markedly) basic carbonate white lead, dibasic lead phosphite, dibasic lead phthalate, etc. Lead content of these will range from as little as 27% (normal lead stearate) to as high as 90% (dibasic lead phosphite).

Lead stabilizers find their greatest utility in formulations where good electrical properties are desirable. They are also very useful for dark-colored materials and for applications where there will be little contact with sulfide fumes.

Other Metallic Compounds

There are a great many of these, in both solid and liquid state. Most manufacturers also market blends or other mixtures of stabilizers, but for simplicity we will consider individual materials only. The powdered

forms are generally metallic soaps, such as laurates, ricinoleates, stearates, etc. They possess the disadvantage of having to be milled into the formulation. They also tend to produce a gel structure in plastisols which results in a higher viscosity. They may be a drawback or an advantage, depending on the formulation.

Solutions or liquids are complex organic compounds of metals, including such bases as phenates, alkyl aryl phosphites or titanates, etc. Some of the bases to which the metallic atom is joined are of value in themselves. Phenates, for example, liberate alkyl phenols as the metallic portion is spent in reaction with hydrochloric acid. These phenols are of further value as stabilizers and antioxidants in the film. Alkyl aryl phosphites can act as chelating agents in the film, suspending the reaction products of the metals. This eliminates a haze which otherwise is frequently encountered. Chelating agents may be added as such or as carriers for the metallic stabilizing material.

TIN

Tin is used in the form of alkyl tin salts or soaps, such as dibutyl tin maleate laurate. Mercaptides, of the dialkyl tin type are also used and, in fact, are of the highest efficiency. Other compounds used are the thiazoles, alcoholates, carboxylates, etc. Each type has its individual properties.

The mercaptides are the most powerful, but the sulfur content poses a problem. If iron or lead pigments are in the formulation, there will be darkening or staining. There can even be staining of vinyl objects in contact with the film, if these objects are lead stabilized. There is also a certain measure of unpleasant odor associated with these materials.

The carboxylates are reputed to be unusually valuable because of the possibility that the released alkyl radicals may attach to the vinyl molecule at places where hydrochloric acid has split off. In this way, the molecule can become stabilized against further breakdown.

The tin compounds are extremely powerful and effective heat and light stabilizers, probably the best single materials. However, they are extremely expensive. Even when allowance for their high potency has been made, they still run too high for use except where really indispensable.

They are of most use in crystal clear formulations, where the best color and clarity are required. No other stabilizer or combination is quite as good for clarity of clears. However, the general heat and light resistance can be matched using other materials, such as barium, cadmium plus epoxy, with only a small reduction in clarity.

CADMIUM

Cadmium is another very expensive stabilizer. It, too, is very efficient. It stains somewhat with sulfur compounds, but not as much as lead does. The tendency to sulfur-stain can be reduced by the cautious use of zinc stabilizer.

Cadmium is used in a variety of forms, generally of undisclosed composition. Usually, liquid forms are complex organic association products. Because of its high price, cadmium is most commonly used in con-

junction with other metals, such as barium or zinc. It seems to act synergistically with other metals, to yield blended results superior to either alone.

Cadmium is widely used for clears as it gives a very good degree of clarity. A very good combination with cadmium as the only metal is cadmium-epoxy resin. Cadmium is a very toxic material, and should be avoided in all food applications.

BARIUM

Barium stabilizers are much lower in cost than cadmium. Barium provides good heat stability, but only fair light stabilization. It is almost never used alone. It is very frequently used with cadmium, both to lower the cost, and for its synergistic effect. Many stabilizer manufacturers market blended cadmium-barium stabilizers.

Barium is not extremely good for clarity. As it acts to accept hydrochloric acid, it develops a milky white smoky appearance. It is best, therefore, to use as little barium as is compatible with stabilizing requirement. High epoxy content can be used to reduce the barium. A good level of organic chelating agent is useful with barium to improve clarity. Barium is non-staining with sulfur compounds since it produces a white sulfide.

Barium is a toxic material, and should be avoided where a non-toxic formulation is needed. Barium is useful in formulations where clarity is not essential, and it is often used to replace lead stabilizers in compositions containing phosphate plasticizers, especially cresyl-containing phosphate plasticizers.

ZINC

Zinc is an unusual material to be considered for a vinyl stabilizer. It is a very reactive metal with vinyls, promoting dehydrochlorination quite markedly. Many vinyl compositions will blacken if baked on a galvanized or zinc surface. Zinc oxide or most other zinc pigments will induce gelling in many vinyl formulations.

Yet organic zinc compounds have a definite place in the field of vinyl stabilization. They are quite synergistic. They tend to reduce the sulfur staining of lead and cadmium materials. Their use with cadmium and barium is almost essential for best performance. Zinc is a non-toxic substance, so it is often used in vinyls for surgical or food applications.

Barium-zinc is a low-priced fairly effective stabilizing combination, frequently used in pigmented formulations, where good clarity is not essential. Calcium-zinc is a popular non-toxic mixture.

Zinc should never be used alone, without other stabilizing substances. This is because of its tendency to promote the decomposition of vinyls. Unbalanced zinc-stabilized formulations will frequently show an unusual, and very undesirable property. That is the appearance of sudden blackening. The film will appear to be stable under heat, but as heating is continued, the coating will suddenly turn black. A substantial degree of decomposition occurs when this takes place.

To guard against this, other stabilizers must also be used. The presence of a reasonable amount of

epoxy stabilizer is helpful, but some barium or cadmium is also advisable.

Zinc does not discolor on contact with sulfides, as it forms a white sulfide.

CALCIUM AND STRONTIUM

These are two metals which are not widely used today. Strontium is used as a solution of strontium naphthenate; and it is the first non-lead and non-tin stabilizer offered for use in vinyl resins. It is limited in stabilizing power, and not ordinarily used except for special applications. Where used, it is advisable to incorporate epoxy stabilizer into the formulation.

Strontium is non-toxic and non-staining. It is used in those applications where these properties make it of interest. It is generally used with calcium or zinc to take advantage of the synergistic value of these metals. Since both are non-toxic, the combinations are often seen in coatings for food containers. Strontium is reasonably effective in solution vinyl coatings, and is occasionally used for this purpose.

Calcium is a rather low-level stabilizer against heat. In combination with zinc as a synergistic agent, it finds a certain amount of use as a non-toxic stabilizer. It is advisable to include a portion of epoxy stabilizer as well in formulations using calcium-zinc. In fact, one company markets a non-toxic stabilizer which is a combination of calcium, zinc, and epoxy all in one. This mixture is approved by the Food and Drug Administration as non-toxic. (Of course there are others which are approved as well).

In general, neither calcium nor strontium can be used where a high degree of stabilization against severe conditions is called for. Fortunately, many non-toxic applications do not call for maximum stabilization.

Epoxy Compounds

These materials have become extremely valuable components in vinyl formulations. Their use is so widespread that at least small amounts can be expected in almost every vinyl formulation of the plastisol type. The reason for this lies in their possession of some very desirable properties. First, and foremost, of course, they possess good stabilizing properties owing to their ability to absorb hydrochloric acid via the epoxy group. Second, they are relatively low in cost. Third, some members of the group, the epoxidized oils or oil esters, can also serve as plasticizing resins. They make non-volatile, low cost, non-migrating plasticizers which can be used to replace a portion of the primary plasticizer. In addition to all this, they are compatible with some of the more difficult plastisol ingredients; and work synergistically with other stabilizers.

The epoxy stabilizers may be divided into two main groups: the epoxidized plasticizers and the epoxy resins which are much higher in efficiency. The epoxy resins are the condensation products of bis-phenol A and epichlorhydrin and are glycidyl ethers.

The epoxy plasticizers are used with almost every stabilizing combination. They are valuable, almost indispensable, with the widely-used cadmium-barium combination. They increase the efficiency and the re-

serve stabilizing power of almost every formulation. Since they can be brought into the formulation as a portion of the plasticizer with a gain in other properties, it is good practice to gain the added stabilizing effect for reserve safety.

The epoxy resins vary in efficiency and compatibility in proportion to their epoxy content. The lower the molecular weight, the greater the efficiency of the resin. For this reason, the semi-solid and the fluid epoxy resins are those generally used for stabilizing purposes. These are, unfortunately, much more expensive than the hard epoxy resins. However, they still compare in a satisfactory manner in price with the good quality metallic stabilizers.

One of the first applications for epoxy resins, in this country, at least, was as vinyl stabilizers. This was before the materials were even available for use as resins in coatings manufacturing. The original material is still available and still used as a vinyl stabilizer.

It should be pointed out, however, that epoxy materials in general are not ideal stabilizers and should not be used as the sole stabilizing substance. They do not possess sufficient protective qualities, and formulations using no other stabilizers will show premature discoloration. The lowest molecular weight epoxy resins are possible exceptions to this generalization, at least for heat stability.

Other Organic Compounds

This is a rather miscellaneous group, but it includes at least a few quite useful materials. All are secondary or synergistic substances, used to improve the efficiency of primary stabilizers. The chelating materials, such as the alkyl aryl phosphite complexes (and items of similar performance are made by almost every other manufacturer of stabilizers) are in quite wide use. These stabilizers are added to reduce the hazing often formed when metallic stabilizers are functioning. They seem to coordinate the degradation products, and keep them in a state of dispersion. This prevents their precipitation, and consequent hazing of the film.

In addition, chelating compounds also definitely extend the effects of metallic stabilizers. By their use, the amount of cadmium-barium or other metallic stabilizer can be reduced; or the efficiency of the same

amount of metal may be increased. Chelating compounds are also useful in the stabilizing of formulations containing large amounts of phosphate plasticizers, which can be difficult to handle. With certain colors, especially reds, sharper colors can be obtained if chelators are present. A number of manufacturers are offering combinations of stabilizing metals with chelating agents, either in mixture or in actual chemical combination with cadmium and other metals.

Other organics occasionally used are the ultraviolet absorbers. These are an empirical, poorly-understood class of materials. They do show valuable properties in certain formulations where unusual light-resistance is necessary. In this group are such items as salol and other salicylates; as well as a great many proprietary materials.

Anti-oxidants are also useful in controlling the rather complicated decomposition of vinyl chloride, in which oxidation plays a definite part. The phosphites used as chelators are also antioxidants, as are the mercaptides used to carry tin as well as the alkyl-phenols often used to solubilize stabilizing metals. All of these are instances of double purpose combinations, where both the metallic portion and the organic portion of the molecular aggregate serve to stabilize the formulation.

However, in certain cases, the antioxidant portion alone is desired in a formulation. It may be added as an alkyl phenol, but more likely as an alkyl phenate of a non-stabilizing metal, such as sodium. Organophosphate combinations with sodium are also available for special applications.

Still other materials are mentioned as stabilizers, here or in other countries. These are acid-acceptors of a variety of types. But they have obtained no foothold among formulators, and require no treatment here.

It will be seen from the information outlined above, that the stabilization of polyvinyl chloride is rather complicated, and influenced by many factors, such as the choice of pigments and plasticizers. Most materials benefit by the use of a number of stabilizers, and it is not uncommon to meet barium, cadmium, zinc, a chelator, an ultraviolet absorber, an epoxy, an antioxidant, and even a lead compound all in the same formula.

FINISHING POINTERS

(Concluded from page 64)

clear, cold running water, the parts are transferred immediately to the next operation, which is an alkaline treatment with current.

The work is made cathodic in a solution consisting of 8 oz./gal. potassium hydroxide (caustic potash) and 3 oz./gal. potassium carbonate, using 10 volts for 20 seconds. A steel tank may be used, which serves as the anode. Gentle agitation is desirable and ventilation is a must because of the caustic spray. Without intermediate rinsing, the parts are now transferred directly to the silver strike bath and immersed with the

current on, which is effected by use of a flexible lead and battery clamp connected to the rack. For best results, the strike consists of 0.6 oz./gal. silver cyanide and 12 oz./gal. potassium cyanide. A voltage of 3-4 is applied for about 10-15 seconds and again, without an intermediate rinse, the parts are transferred to the silver plating solution, after first making a positive electrical connection to the rack as in the strike operation.

Deionized water is strongly recommended for make-up and replenishment, to avoid solution contamination, and deionized spray rinses are particularly effective between operations. Although the cycle outlined above may appear to be inordinately complicated, when compared to the usual procedures, results have indicated that adhesion is made certain.

Hydrostatic Spraying of Organic Finishes

By J. Arthur Weed, *Consultant, Kirklyn, Penna.*

IN a recent article, the writer mentioned very briefly, a new method of applying paint and other protective coatings by means of hydraulic or airless spraying. This article was of necessity very short and I would like to explain this process in much more detail, as I feel that it is one of the major developments in the spray painting field in recent years.

There is nothing new about the spraying of liquids by means of hydraulic pressures rather than by compressed air. The use of this medium in the spray painting field is comparatively new and a great deal of credit should be given to the men and companies who have had the vision and the fortitude to stick with it, even though the problems encountered have been many and solving them very costly.

What is hydraulic atomization and how does it work? To spray by means of hydraulic pressure, it is necessary to have a source of power that will create extremely high fluid pressures within a closed system. The material that is to be atomized is forced through a specially designed small orifice. The desired degree of atomization is controlled by the orifice size, the viscosity of the material, and the pressure that is used. The viscosity can be controlled by the application of heat or by the use of thinners or solvents. It is imperative that this viscosity be kept constant at all times.

When equipment of this type was first introduced to the finishing industry, it left much to be desired. As with many new products, it was sold indiscriminately, as a "cure-all" for any problems that the user may have. Unfortunately, in many cases, it rather discouraged the user and led him to believe that it was not

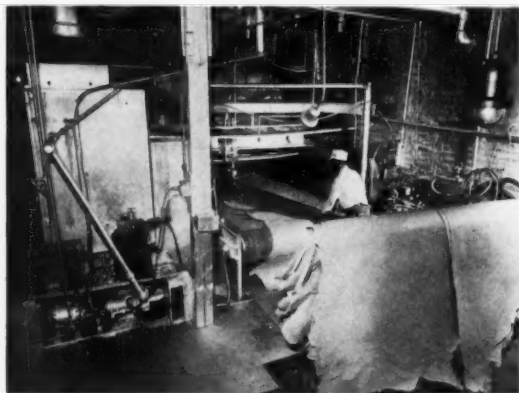
practical for many jobs. However, the basic principle was excellent and, in the past few years, many things have been accomplished that make this new process adaptable to the spraying of many finishes that could not be previously handled.

The heart of any system that sprays by means of hydraulic pressures, is the pump. As most paints are abrasive, it is necessary that the pump be designed to withstand wear from this source and be able to produce the pressures that are essential to its operation. It is also imperative that the material be delivered with no pulsation. Most of the pumps that are available today fill the above requirements and are operated mainly by compressed air. Since there is no air used in the atomizing of the paint, merely to operate the pump, the air consumption is negligible. This is a very important factor to consider when evaluating the advantages of using this type of equipment.

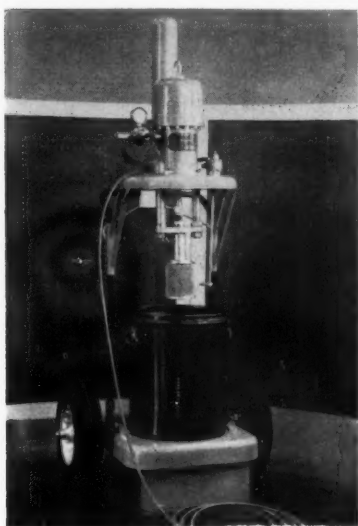
One of the other problems that had to be solved was a satisfactory spray gun, designed to handle the extreme pressures involved, along a suitable fluid nozzle that would stand the abrasiveness of the materials being sprayed. A fluid nozzle of the internal type was required and the early types used, because they were made of brass or steel, wore rapidly and had to be replaced. Today, there are nozzles of the correct spray patterns, made of tungsten-carbide, that give excellent service. Changing the size of the spray pattern involves replacement of the fluid nozzle with that of the desired size; however, this is easy to accomplish. Today, there are both manual and automatic spray guns available for most types of materials which operate extremely well.



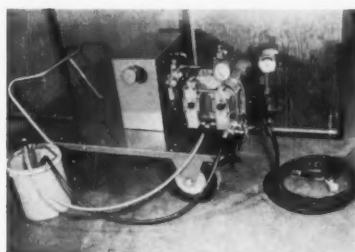
(Courtesy Spee-Flo Corp., Houston, Texas)
Fig. 1. Stationary unit showing spray gun, hose, heater, and pressure pot.



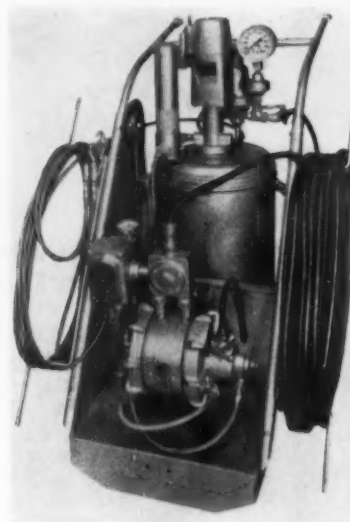
(Courtesy Nordson Corp., Amherst, Ohio)
Fig. 2. Hydrostatic spraying being used to coat leather sheets on a flat conveyor table.



(Courtesy Gray Co., Minneapolis, Minn.)



(Courtesy Nordson Corp., Amherst, Ohio)



(Courtesy Spec-Flo Corp., Houston, Texas)

Fig. 3. Portable hydrostatic spray units.

In handling pressures of 400 to as much as 2000 psi, it was also necessary to find a suitable hose that would stand these extreme pressures, be solvent resistant and also handle materials that were heated to as much as 180°F. Synthetic hose of this type is now in use and is giving very satisfactory service.

There are two schools of thought in hydrostatic spraying, one that advocates the use of heat and pressure, the other using pressure only with a reasonable temperature control of the material. It appears that both are satisfactory and each has its definite place in the organic finishing industry. There are also materials that do not lend themselves to this type of spraying, fibrous materials and materials in which a catalyst is used that has a short pot life.

With the use of hydrostatic or airless equipment it is now possible to paint items, such as large machinery, in an open shop area with normal ventilation, when it is not practical to move these objects into a suitable spray booth. This type of equipment is also ideal for maintenance work, due to the lack of overspray that is experienced with conventional spraying methods.

A very important feature of this method of spraying, is that it makes possible the spraying of the interiors of products, such as cabinets, etc., with a minimum of blow-back, producing more thorough coverage of inside corners and surfaces. It also improves working conditions for the operator of this type of work.

Hydrostatic or airless spraying should not be confused with ordinary hot spray painting. Although hot spray painting has many advantages in most cases over conventional painting, it still uses compressed air as the medium of spraying and has some of the drawbacks of the conventional methods. The paint heaters that are used with this new method are also designed to withstand much higher pressures than are used with ordinary hot painting.

The average spray painter, who is accustomed to conventional spraying methods, has a tendency to apply too much material, when he is first introduced to hydrostatic painting. With a little instruction and practice, he readily becomes just as proficient with the

new method. It is, therefore, imperative that he be given the proper instruction by factory or trained personnel.

If the material to be sprayed is of the type to which heat would be beneficial, it is imperative that the temperature be maintained at all times at the gun. Units that are available make provision for this, either by recirculation or by means of thermostatically controlled, heated hose.

Overspray, paint fog and rebound are drastically reduced by this new method of painting and exhaust requirements are lowered. Some manufacturers of equipment state that 60 fpm face velocity in the spray booth is adequate. However, the user must adhere to the various state and local codes relating to paint spray booths and should consult with the proper agencies before any changes are made.

The material savings that have been reported by the users of this new method of spraying have been very great and in some cases as high as 60%. The average has been about 25% which is still a very worth while savings.

In summing up the case for hydrostatic painting, some of the many advantages that may be obtained follow:

1. Material savings, due to reduction in overspray.
2. Labor savings, due to increased speed of application.
3. Increased production, less coats required for necessary film thickness.
4. Savings in compressed air.
5. Less rejects.
6. Improved housekeeping, cleaner work areas.
7. Smoother finish, less possibility of orange peel.
8. Lowered exhaust requirements.
9. Less cleaning of booths and ducts, reduction in fire hazard.
10. Better employee relations.

The above are only a few of the most important features of this method of spraying. Manufacturers of the equipment can give the potential user many more.

Science for Electroplaters

49. Copper Plating

By L. Serola

THE elements belonging to sub-group I in the periodic classification, namely copper, silver, and gold, unlike the reactive alkali metals identified with the main group I, are relatively noble metals and are not easily oxidized. The oxidation rate or electro-positive nature of the three metals decreases, proceeding from copper to gold, with the latter element being one of the most noble metals.

Whereas, the alkali metals, without a single valence electron in the outer orbit, exhibit a positive, plus one (+1) state of oxidation in compound formation, the noble metals, in addition to a plus one oxidation state, may also form compounds with an oxidation state (valence) of +2 for copper and +3 for gold. The marked differences in properties between the alkali metals in the main group and the noble metals in the sub-group are attributed to the difference in electron arrangement of the underlying levels. The outer 18 electron shell of the kernel for copper, silver, and gold is more readily deformed than the 8 electron underlying group for the alkali metals: so that it is possible to remove one or two electrons from the 18 electron shell, thus accounting for the higher oxidation states of copper and gold. An additional property of the noble metals associated with the electronic configuration is that the ions of the sub-group elements form complexes.

Copper deposition is possible from a bath containing either the higher valence (Cu^{++}) cupric salt or the lower valence (Cu^+) cuprous type. Solutions for the cupric salt include the acid copper sulfate and copper fluoborate baths with very low pH values, as well as the alkaline copper pyrophosphate bath with a pH range of 8.2-8.8. The cup-

rous type, with a valence of one, are mainly complex cyanide solutions.

Although deposition from a cupric salt bath will attain a cathode efficiency close to 100 percent, especially the acid copper sulfate, direct plating from acid baths on steel or zinc must be preceded by a deposit from a copper cyanide (strike) solution to avoid immersion plating, which produces loose non-adherent films of copper.

Another disadvantage of the acid bath is that deposits of more than 0.001" in thickness, on a stationary cathode, require polishing or buffing. In addition, divalent copper in the acid bath requires 2 faradays to deposit the gram-atomic weight instead of one faraday for the cuprous or monovalent ion present in the cyanide bath. *W. Blum* and *G. B. Hogaboom* indicate that a copper deposit from a cyanide bath should also precede plating on ferrous metals from the alkaline pyrophosphate copper solution.

Another factor favoring copper plating processes from cyanide baths is the improved throwing power exhibited by these baths compared to the acid copper solutions. *C. E. Reinhard* notes that acid-copper solutions exhibit better microthrowing power than cyanide-copper solutions in plating irregularly shaped objects. Microthrowing power is defined by the author as the ability of a plating solution to deposit metal in pores. *W. R. Meyer* attributes this property of higher microthrowing power in acid copper solutions to the ability to deposit metal at lower potentials than that used for the cyanide solutions.

Although the current efficiency for many cyanide baths ranges from 50-70 per cent, a high speed copper cyanide solution containing a high concentration of copper with relatively low free cyanide, in addition to its superior throwing power, operates at a current efficiency close to 99 per cent. The high concentration of a cuprous ion in the

bath may result in deposition of copper by displacement, so that an initial copper strike from a more dilute solution is advisable.

The poorer throwing power of the acid copper baths compared to the alkaline baths is attributed to the low cathode polarization (indicating a low voltage requirement), with disposition following primary current distribution. *W. Safranek* and *J. H. Winkler* refer to a voltage as low as 0.25 in copper refining, with cathode and anode current densities of 15-20 amp./ft.² A high cathode current density of 200 amp./ft.² will require only 6 volts, with adequate agitation. Copper deposits more than 0.001" in thickness on stationary cathode, *Winkler* notes, must be buffed or polished.

Through the use of addition agents the problems previously mentioned have been lessened appreciably. This is so especially in the copper sulfate bath, where addition has served to reduce the coarse grain character of the copper deposit, increase the limiting current density, improve brightening and lessen the tendency for treeing.

The principal applications for copper deposits from the acid baths include the following: electrorefining; producing copper powder used for sintering; electroforming, as recording matrices; the building up of undercoats for nickel plate, following an initial strike plate from a cyanide bath; electrotypes; copper coatings on non metallic products; copper plated stainless steel cooking utensils; thick deposits for steel rolls; and as a protecting coating for steel in case-hardening. Applications for copper deposits from the cyanide bath include the initial layer or strike film on zinc die cast or steel, to overcome immersion plate and as an undercoat for nickel and chromium deposits.

Acid Copper Sulfate

The principal constituents in this

TABLE 1
Solubility of Copper Sulphate in the Presence of Sulfuric Acid—25°C.

gm.-equiv. per liter Free H_2SO_4 CuSO_4		g. per 100 cc. Free H_2SO_4 $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$		Density
.1488	2.784	.7291	34.740	1.2105
.4208	2.634	2.0619	32.867	1.2070
.8680	2.457	4.2532	30.659	1.2115
1.345	2.320	6.5905	28.950	1.2130
1.876	2.181	9.1924	27.215	1.2165
1.914	2.153	9.3786	26.866	1.2162
3.077	1.837	15.0733	22.923	1.2229
3.659	1.649	17.9291	20.577	1.2267

bath are copper sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, and sulfuric acid, H_2SO_4 . The function of the cupric salt is to furnish the metals ions Cu^{++} , while that of the acid is to increase the conductivity of the solution by providing a large quantity of hydrogen ions, reduce the metal ion concentration, aid anode corrosion, and prevent the precipitation of basic cuprous or cupric compounds due to the presence of free acid. The quantity of sulfuric acid that can be added is governed by the effect upon the solubility of copper sulfate.

H. M. Goodwin and W. G. Horsch demonstrated experimentally that the solubility of copper sulfate will decrease with an increase in concentration of sulfuric acid. Table 1, compiled by E. F. Kern and M. Y. Chang from the experimental data, shows that a concentration of 2 g./100 cc. (2.7 oz. gal.) sulfuric acid will dissolve 32.9 grams (44.3 oz./gal.) copper sulfate, but a concentration of 17.9 g./100 cc. (24 oz./gal.) sulfuric acid will dissolve only 20.6 grams (27.6 oz./gal.) of copper sulfate. The values for grams per 100 cc. from gram-equivalent are obtained as follows. The equivalent weight for $\text{H}_2\text{SO}_4 = 98$

$$- \text{or } 49, \text{ and for } \text{CuSO}_4 \cdot 5\text{H}_2\text{O} = \frac{249.6}{2}$$

$$\text{or } 124.8; \text{ hence } \frac{0.1448}{10} \times \frac{98}{2} =$$

$$0.7291 \text{ gram free } \text{H}_2\text{SO}_4 \text{ and } \frac{2.784}{10} \times$$

$$\frac{249.6}{2} = 34.74 \text{ grams } \text{CuSO}_4 \cdot 5\text{H}_2\text{O}. \text{ To}$$

obtain ounces per gallon use the factor g./l. $\times .134 = \text{oz./gal.}$ or $32.9 \times 10 \times 0.134 = 44.3 \text{ oz./gal.}$ $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

H. K. Richardson and F. D. Taylor, in a study of conductivity of mixtures of copper sulfate and sulfuric acid, found that additions of copper sulfate to solutions of sulfuric acid will have the following effects: the conductivity of the mixture increases if the concentration of sulfuric acid is less than 3 grams per 100 cc.; no effect on the conductivity will result if the concentration of the sulfuric acid is 3 grams per 100 cc. (30 g./l.); conductivity of the mixture decreases if more than 3 grams per 100 cc. of sulfuric acid is used. Table 2 represents the values obtained for conductivity, expressed in reciprocal ohms per cm. cube for mix-

TABLE 2
Conductivity Expressed in Reciprocal Ohms per Centimeter Cube

H_2SO_4 , g./100 cc.		0	25°C. 5	10	15	20
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ g./100cc.	0	-----	0.208	0.410	0.565	0.863
	5	0.0153	0.2040	0.388	0.531	0.646
	10	0.0221	0.195	0.350	0.500	0.600
	15	0.0348	0.189	0.338	0.458	0.558
	20	0.0423	0.182	0.319	0.433	-----

tures of copper sulfate and sulfuric acid. The probable error is estimated at less than 0.5 per cent. The table also indicates that the conductivity is almost doubled when the acid concentration is increased from 5 g./100 cc. (50 g./l. or 6.7 oz./gal.) to 10 g./100 cc. (100 g./l. or 13.4 oz./gal.).

Throwing Power

In addition to conductivity, a second governing factor in electrodeposition processes, considered by H. E. Haring as affecting throwing power or current and metal distributoin, is electrode polarization. Polarization is considered by Kronsbein as due to any deviation of current distribution from the primary current distribution. Blum notes that the difference in potential in the deposition of copper and hydrogen at the cathode is such that copper, with the lower potential, will deposit first. Metal distribution depends upon secondary current distribution and cathode efficiency. Haring and Blum, investigating current distribution and throwing power with a Haring cell, used a copper sulfate (acid) solution because this solution permits a wide range of conditions yielding satisfactory deposits with high cathode efficiencies. A standard solution was prepared consisting of 1.5N CuSO_4 and 1.5N H_2SO_4 .

Some of the results obtained and conclusions based upon various conditions studied are as follows: Changes in current density (room temp.-no agitation) had little effect upon throwing power. Thus, for a total current of 2 amperes for 1 hour, with a standard solution, the throwing power was 9.4 per cent; whereas, with a total current of 1 ampere for 1 hour, the throwing power was 9.6 per cent; and a 3 ampere, 40 minute period gave a throwing power of 8.2 per cent. Under the conditions used for the standard solution, current, time, concentration, etc., an increase in temperature results in a decrease in throwing power. The throwing power, 9.4 per cent, for the

standard solution at 21°C. is reduced to 2.2 per cent when the temperature is increased to 45°C. Agitation with air caused a decrease in throwing power from 9.4 per cent for the standard solution at 21°C. to 3.4 per cent. The drop in throwing power is attributed to the effect on the cathode film and the reduced polarization. An increase in the copper sulfate concentration from the standard 1.5N to 2.0N at a high current density will reduce polarization but will increase somewhat the resistivity of the solution, causing a decrease in throwing power from 9.4 per cent to 7.4 per cent.

The same concentration change in sulfuric acid will, however, result in an increase in throwing power from 9.4 per cent for the standard solution to 10.8 for the 2.0N solution. The increase in acidity will not effect the polarization very much but will result in a decrease in resistivity and an improved throwing power.

Addition Agents

The use of addition agents in acid copper sulfate baths, to eliminate coarse grained deposits or reduce the tendency for treeing, has been extensive. B. Clark and O. E. Jones classify addition agents as the colloidal type, such as glue, gelatin, or phenol, and the crystalloid type, such as aluminum sulfate, tin chloride, etc.

Their investigation of the effect of a number of addition agents upon a deposited copper leads them to these conclusions: polarization increases with an increase in current density; conductivity of the solution decreases and the grain size of the deposit is reduced, the latter phenomenon being associated with cathodic polarization.

Of the addition agents studied, gelatin (0.3 g./l.) when added to a bath consisting of 0.5 gm-mol/l copper sulfate and 1.0 gm-mol/l sulfuric acid, showed the most pronounced increase in polarization (with a Haring cell) with current density increases from 0.1 to 2.3 amp./dm.², at 20°C. Di-

methylaniline and grape sugar showed rapid initial increases in polarization, but the rate of increase became slower with increasing current density (0.5 amp./dm.²) and again showed an increase in polarization rate at a current density of 1 amp./dm.². Lactic acid in concentrated form, and starch showed a steady drop in the rate of increase of polarization with increasing current density; peptone and camphor showed declines in the increased rate of polarization with increasing current density.

Haring, in a study of anode and cathode polarization measurements by means of the Haring cell, used glue as an addition agent in a copper sulfate solution (1.5N CuSO₄ + 1.5N H₂SO₄). The results, represented graphically in Fig. 197, indicate the polarization, volts with increasing current density for concentrations of 0.002 g./l. (Curve 2) and 0.02 g./l. (Curve 3), compared to results obtained without the presence of glue in the copper solution (Curve 1).

An excellent example of the effect upon the surface of a heavy copper deposit (0.075") when a few parts per million of glue is used as an addition agent is shown in Fig. 198. The coarse structure and nodule formation of the plate on the right changed markedly in surface roughness when glue was added, as is evident by the appearance of the plate on the left.

A. K. Graham found that polariza-

tion decreased when 7.5 g./l. (1 oz./gal.) of pure aluminum sulfate, Al₂(SO₄)₃·16H₂O was used as an addition agent in an acid copper sulfate bath (1.5N CuSO₄ + 1.0 N H₂SO₄). This resulted in an increase in nuclei formation, causing a treed deposit. For a current density of 27.9 amp./ft.², 25°C., the cathode polarization volts changed (dropped) from 0.1936 to 0.1818 when the aluminum sulfate was added.

The addition of 0.02 g./l. (0.003 oz./gal.) of gelatin to the bath, Graham found, showed increased polariza-

tion. The polarization volts, upon the addition of the gelatin, increased from 0.1341 to 0.2386. The structure of the copper deposit changed from broken (fine) to fibrous form. C. G. Fink and C. A. Philippi also found, in their voltage studies in copper refining, that small additions of gelatin to a solution consisting of CuSO₄·5H₂O, 120 g./l., and H₂SO₄, 130 g./l., operating at a current density of 15 amp./ft.², greatly increased the cathode polarization.

A hard, smooth deposit of copper was obtained in shorter time for electrolyses by R. O. Hull and W. Blum with the addition of phenolsulfonic acid to an electrotyping solution. It was found that results with this addition agent were best when electrolysis was continued (the bath dummied) for a few days. The following composition and operating conditions were found satisfactory for electrotyping: CuSO₄·5H₂O—0.5N (250 g./l. or 33 oz./gal.), H₂SO₄—1.5N (75 g./l. or 10 oz./gal.); phenolsulfonic acid, C₆H₄OH·SO₃H,—1 g./l. (0.13 oz./gal.); temperature 35-40°C. (95-104°F.), current density 230-280 amp./ft.² with good (air) agitation.

R. Taft considers the action of an addition agent as one of adsorption or reduction of the addition agent with the metal ion. Results obtained by Taft and Messmore gave clear indication of adsorption phenomena in copper deposits with gelatin or glue present.

The second effect proposed, reduction, was observed by the appearance of a more adherent and finer grained copper during electrolysis, upon the
(Continued on page 81)

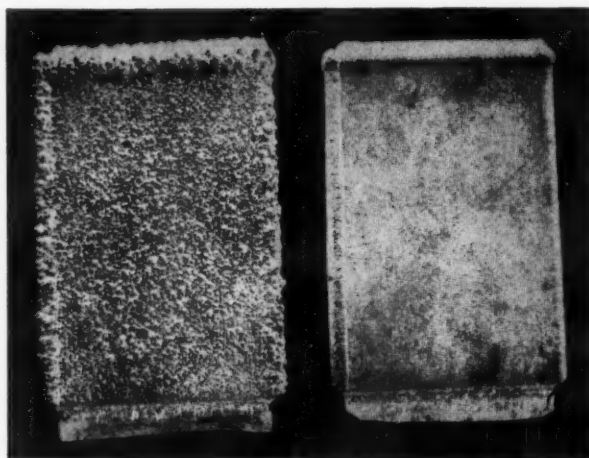


Fig. 198. Heavy (0.75-inch) deposits from copper sulfate-sulfuric acid solution. Note nodules and coarse structure of left panel produced without addition agents, compact deposit at right produced with a few ppm of animal glue.

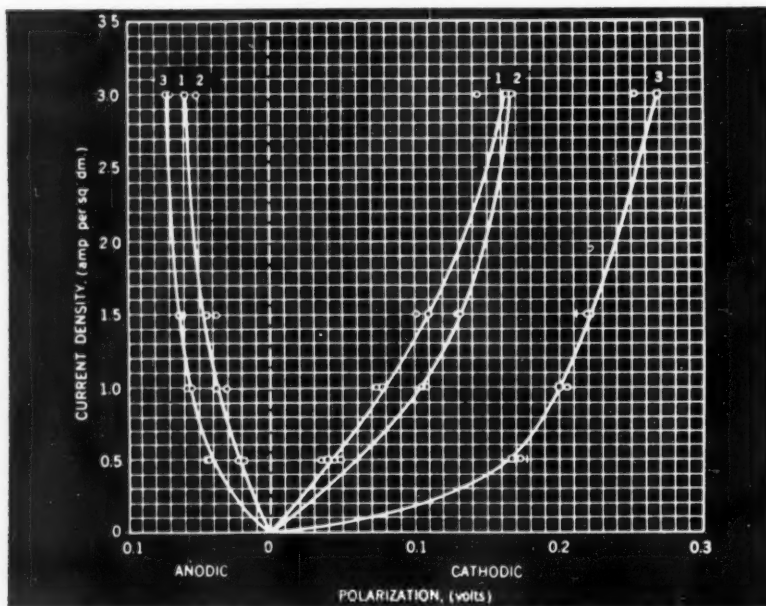


Fig. 197. Anode and cathode polarizations in copper sulfate. Curve 1: Solution A, 1.5N CuSO₄ + 1.5N H₂SO₄. Curve 2: Solution A + 0.002 g./l. of glue. Curve 3: Solution A + 0.02 g./l. of glue. (Derived from H. E. Haring, Trans. Am. Electrochem. Soc., vol. 49, p. 417, 1926.)

SHOP PROBLEMS

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METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Electropolishing Molybdenum

Question: We have looked through the METAL FINISHING GUIDEBOOK chapter on electropolishing but find no formula for electropolishing molybdenum in this otherwise excellent compilation. We have seen samples of metal which appeared to have been brightened by this process and would appreciate your advising whether this is possible and where further information can be obtained if you are not able to suggest any methods.

R. M. H.

Answer: Phosphoric acid-sulfuric acid mixtures, similar to those for electropolishing stainless steel but containing more water, have been found suitable for molybdenum. A typical formula would consist of:

Phosphoric acid	4 gal.
Sulfuric acid	1 "
Water	4 "

The articles are made anodic at room temperature and 10-14 amp./in.² for about 30 seconds, then dipped in denatured alcohol prior to water rinsing, to avoid attack on the molybdenum by the diluted acid. The very high current density will necessitate electrical equipment which will deliver 25-30 volts.

The straight sulfuric acid-water solutions require a lower current density but may not produce as good a finish. A typical solution consists of 2 parts acid to 1 part water, which is used at room temperature and 100-300 amp./ft.², requiring from 10-24 volts, depending on the concentration of the bath. A film of blue molybdenum oxide is formed on the surface as a result of electropolishing. This film may be removed by immersion in trisodium phosphate or caustic soda solution, or in an alkaline cleaner.

Blue Chromium

Question: We are seeking information regarding a chrome plating solution for plating blue chrome; also about a chemical process for blueing chrome plating. Any information you might send us on this will certainly be appreciated.

E. W.

Answer: It has been claimed that a blue-colored chromium deposit can be obtained from a chromium solution with a sulfate ratio of 80:1, by adding 2 oz./gal. boric acid, and operating the bath at 85° F., and low current densities.

Chromium deposits will turn blue when heated to the oxidation point. However, this method is not suitable for hardened and tempered basis metals. We know of no chemical method.

D-Chrom Bath

Question: Do you have any details about a chromium plating process called the D-Chrom Bath for plating directly on aluminum?

N. K.

Answer: The D-Chrom bath is a "tetrachromate" bath and is made up with:

Chromic acid	50 oz./gal.
Sulfuric acid	0.2 "
Soda ash	10 "

About 1½ fl. oz. methanol are added to each gallon of new solution to produce the required amount of trivalent chromium. The bath operates at 200-600 amp./ft.², and 60-70 deg. C., with a cathode efficiency of 30-35%, which is quite high.

An essential part of the process is the interruption of current for 1-2 seconds, after a 10 second plate, to alter the structure of the deposit and make it easier to polish. The deposit is a semi-

lustrous gray, with a hardness of 400-500 Vickers, and is said to be satisfactory for plating on aluminum without any undercoating.

Zinc Analysis in Brass Solutions

Question: We were interested in reading Leftin's article on direct titration of zinc in cyanide solutions using EDTA. While this method works well for us in zinc solutions, we are unable to get a good end point in brass solutions, probably due to interference from copper. It was our hope Leftin's paper might disclose some step which would help us. He does say, page 75, that excessive amounts of cyanide, hydroxide, carbonate, etc. interfered seriously with the titration.

If you have any suggestions on our problem we would be glad to hear from you.

J. D. D.

Answer: Satisfactory results have been obtained with the E.D.T.A. method for zinc in brass solutions, but it is necessary to titrate very rapidly with agitation to the end point, since there is a color reversion. Use a 2 cc. sample of solution, to which are added 90 cc. water, 10 cc. ammonia, Eriochrome Black indicator to produce a deep red, then 10 cc. of 10% formaldehyde solution by volume.

Cratering

Question: We have a recurring problem with "cratering" in our spray paint department. It is not confined to any one type of material or to any one supplier's material. We do feel that we have established beyond a reasonable doubt that the trouble is not in the air used in spraying, but that's about all we seem to have been able to establish.

The material seems to pull away in holes from pinpoint size to ¾" from the base material we are covering — steel, aluminum, plastic — leaving the bare material showing through a film of paint so thin as to be transparent. Have you any ideas?

A. P. M.

Answer: Since you have established beyond a reasonable doubt that the

trouble is not in the compressed air used in spraying, with the information you have provided a strong possible cause for the cratering is a formulation incompatibility. That is, are the pigments and/or resins used compatible with the other components or with one another? Perhaps the solvent is incompatible with the new composition.

In a recent problem experienced by the writer involving cratering, the cause proved to be a very slight film of silicone oil having first been deposited on the metal to be coated. Items which had been lubricated with a silicone and placed in an oven 30' distant from the spraying area released some of the material, thereby producing the condition.

Test for Chromate Coatings

Question: Do you know of any chemical test which may be applied to an item of unknown origin which will disclose whether or not it has had a chromate conversion coating? I am speaking of an item which is fairly bright in color with no yellow tinge and which has no iridescence.

J. D. D.

Answer: The test solution for chromate films on zinc and cadmium is the following:

Water	40 ml.
Acetic acid	60 "
Hydrochloric acid	15 "
15% sodium hypochlorite	30 "
100 vol. hydrogen peroxide	5 "
Diphenylcarbazide	1 g.
Wetting agent	0.1 "

The ingredients are added in the above order, and the solution is aged for 24 hours before use. One drop of the solution is applied to the surface and will turn pink to red in the presence of a trace of chromate.

Plating Foil-Backed Stone Jewelry

Question: I would appreciate your opinion on how to plate stoned jewelry without removing foil from stones. We are plating nickel and gold, but the foil seems to be removed in our cleaning cycle prior to plating.

K. W.

Answer: It is necessary to use an inhibited cleaner to avoid attack on aluminum foil. You should get in touch with your supplier concerning suitable materials for your purpose, furnishing him with foil samples.

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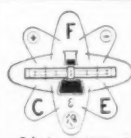
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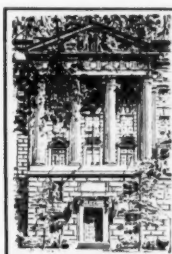
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Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Plating Method

*U. S. Patent 2,856,333. Oct. 14, 1958.
P. J. Topelian, assignor to Tiarco Corp.*

A process of electroplating an article formed of a metal selected from the group consisting of aluminum, titanium, zinc, and lead comprising subjecting the article having a temperature substantially equal to room temperature to the action of hydrogen chloride gas, removing the article from the hydrogen chloride gas medium when the article appears to sweat, and electroplating the article.

Anode Basket

*U. S. Patent 2,856,345. Oct. 14, 1958.
J. Pociask, assignor to American Spring & Wire Specialty Co.*

A frame bent at one end to form a hook for connection to a bus bar, said frame being elongated and having a bent portion at the other end terminating in a transversely extending lug, said frame having an inwardly extending flange terminating in spaced relation to each end thereof, and an elongated article retainer mounted on said frame, said article retainer being helical in conformation, said flange having a plurality of longitudinally spaced openings for loosely receiving successive convolutions of said retainer, one end of said retainer having meeting convolutions converging to form a substantially frusto-conical receptacle resting on said lug.

Paint Brush Cleaning Tool

*U. S. Patent 2,856,622. Oct. 21, 1958.
F. G. Jacobsen*

A paint brush cleaning tool comprising a handle and a plurality of relatively stiff comb teeth of substantially similar form.

Cleaning-Phosphating Process

*U. S. Patent 2,857,298. Oct. 21, 1958.
C. W. Smith*

An opalescent to clear, stable liquid compositions for simultaneously cleaning and phosphating metal surfaces

consisting essentially of about 50-80 per cent of an aqueous acidic phosphating solution; about 4-30 per cent of a hydrocarbon solvent for grease and oil; and about 10-30 total per cent of an emulsifier and an alkali metal alkyl benzene sulfonate detergent, wherein said hydrocarbon solvent has an initial boiling point of about 200°-450° F. and a final boiling point below about 700° F. and wherein the alkyl benzene sulfonate portion of said detergent has a molecular weight of about 290-420.

Abrasive Blasting

*U. S. Patent 2,857,715. Oct. 28, 1958.
H. Hastrup and R. C. Hastrup*

An abrasive blast cleaning machine having a blast nozzle head the outer end of which is adapted to serve as a contacting member to be held against a surface to be cleaned, thereby to surround an area of said surface and enclose the space between said area and said blast nozzle head.

Plating Rack

*U. S. Patent 2,858,266. Oct. 28, 1958.
M. S. Schneider*

An electroplating rack comprising a main current conductor, clamp means having opposed substantially parallel side portions straddling and snugly receiving said main conductor therebetween.

Process for Enameling Aluminum

*U. S. Patent 2,858,245. Oct. 28, 1958.
J. A. Carroll and J. H. Thirsk, assignors to Amchem Products, Inc.*

The method of applying vitreous enamel coatings to aluminum and aluminum alloys which comprises subjecting the metal surface to be enameled to a sequential series of operations to clean and pretreat said surface before applying and firing the enamel coating, comprising first subjecting said surface to the action of an aqueous alkali solution, thereafter subjecting said surface to the action of a deoxidizing solution capable of dissolving

metallic oxides, and then forming a chromate conversion coating on said surface by subjecting it to the action of an aqueous acidic solution containing hexavalent chromium ions and fluoride ions, rinsing the surface to remove the treating solution, and thereafter applying the enamel.

Purification of Cyanide Plating Baths

*U. S. Patent 2,858,257. Oct. 28, 1958.
M. Ceresa and W. L. Bohman, assignors to Westinghouse Electric Corp.*

In the process of treating an aqueous alkali cyanide electrolyte of the group consisting of gold, silver, copper, brass, zinc and cadmium containing an excess of carbonate, having a deficiency of free alkali metal cyanide and having organic impurities, the steps comprising adding to the electrolyte a composition comprising an admixture of calcium cyanide, alkali metal cyanide and calcium oxide in the proportions of from 25% to 75% by weight of calcium cyanide, from 45% to 10% by weight of alkali metal cyanide and from 50% to 5% by weight of calcium oxide, the composition being added in an amount sufficient to react with the excess of the carbonate to form a precipitate of calcium carbonate, there remaining not less than about 4 ounces per gallon of alkali carbonate in the electrolyte, and to introduce additional free alkali metal cyanide to remedy the deficiency, the composition maintaining the pH of the solution at a level of not over substantially 10 ounces per gallon of alkali hydroxide to promote the rapid settling of the calcium carbonate precipitate in an easily filterable, relatively coarse particle size which precipitate occludes organic impurities in the electrolyte, agitating the electrolyte and the added composition until the reaction is substantially complete.

Plating Rack

*U. S. Patent 2,858,265. Oct. 28, 1958.
M. S. Schneider*

A rack for use in an electroplating bath comprising a main bus bar, an auxiliary bus bar, detachable clamping means maintaining said main and said auxiliary bus bars in fixed transverse relationship, said clamping means having two twin half members, each of said half members having an end bracket-like portion engaging an aligned portion of said auxiliary bus bar.

Varnish Flatting Agent

*U. S. Patent 2,858,284. Oct. 28, 1958.
E. G. Acker and L. O. Young, assignors to W. R. Grace & Co.*

A flattening agent especially suitable for use in varnish formulations characterized by a reduced tendency to settle on standing and an improved resistance to comminution during milling of the gel into the varnish base with concomitant loss of flatting power, said flatting agent comprising a comminuted silica xerogel having adsorbed thereon about 45-60 per cent of a primary monohydric alcohol containing not more than 5 carbon atoms.

Corrosion Inhibiting Coating

*U. S. Patent 2,858,285. Oct. 28, 1958.
W. C. Johnson, assignor to E. I. du Pont de Nemours & Co.*

A corrosion-inhibiting coating composition comprising a drying oil, pigment composition including at least 2% by weight of zinc oxide based on the total pigment content, said total pigment content representing about 20% to 50% of the volume of the non-volatile components of the composition, and a barium salt of wool fat fatty acids, said salt of wool fat fatty acids being present in an amount of about 2.3% to 5.0% based on the weight of the total composition.

Polishing Belts

*U. S. Patent 2,858,651. Nov. 4, 1958.
R. H. Shaw and R. H. Shaw II, assignors to The Shaw Belting Co.*

A polishing belt comprising a plurality of mutually fastened layers, including a continuous back layer, an intermediate layer comprising a plurality of spaced parallel felt ribs, and a continuous face layer over the ribs to be used for polishing operation.

Vapor Blasting

*U. S. Patent 2,858,653. Nov. 4, 1958.
F. E. Gupill, Jr., assignor to The Texas Co.*

A method for abrading an object comprising mixing a vaporizable liquid with particles of an abrasive solid material to form a flowable mixture; passing said flowable mixture through a tubular zone as a confined stream; heating said mixture during passage through said tubular zone to a temperature above the boiling point of said liquid and forming therein a high velocity flowing dispersion of said particles in vapor; and discharging said

dispersion at high velocity from said tubular zone into free space, and then against said object.

Electrostatic Coating

*U. S. Patent 2,858,798. Nov. 4, 1958.
J. J. Sedlacsik*

An electrostatic atomizing apparatus of the class described, comprising discharge electrode means, a rotating metallic disc adapted to be spaced from an article to be coated and which article is of an opposite polarity to that of said means for constituting a collector electrode.

Gas Plating

*U. S. Patent 2,859,132. Nov. 4, 1958.
L. J. Novak and H. J. Homer, assignors to The Commonwealth Engineering Co. of Ohio*

The method of gas plating bright, smooth metal coatings which comprises bringing a mixture of metal-bearing vapor and a gaseous brightener compound containing nitrogen into contact with the article to be plated, and heating the gaseous mixture to a temperature sufficient to cause decomposition of the metal bearing vapor and deposition of the metal constituent onto the surface of the article, said nitrogen-containing compound being selected from the group consisting of ammonia, methenamine, nitrous oxide, and ammonium hydroxide.

Chromate Coating Aluminum

*U. S. Patent 2,829,144. Nov. 4, 1958.
B. R. Jeremias, assignor to Poor & Co.*

A coating composition for aluminum and aluminum alloys consisting essentially of sodium dichromate, chromic acid, fluoboric acid and ammonium chloride dissolved in water at a pH within the range of 1.6 to 2.1, the weight ratio of chromium in the dichromate to chromium in the chromic acid being within the range of 10:1 to 1:4, the mol ratio of HBF_4 to CrO_3 being within the range of 1:2 to 1:3, and the quantity of ammonium chloride being within the range of 4% to 32% of the total weight of fluoboric acid and ammonium chloride.

Conversion Coating Zinc

*U. S. Patent 2,859,146. Nov. 4, 1958.
A. F. Prust, assignor to Republic Steel Corp.*

The method of treating a galvanized metal surface to inhibit wet storage stain which comprises exposing the sur-

face to a dilute aqueous solution of borax and phosphoric acid, containing sodium nitrite in amount of at least about 0.1%, the borax being in greater amount than the phosphoric acid, and drying the treated surface.

Conversion Coating Aluminum

*U. S. Patent 2,859,147. Nov. 4, 1958.
B. R. Jeremias, assignor to Poor & Co.*

A coating composition for aluminum and aluminum alloys consisting essentially of chromic acid, phosphorus acid, a complex water soluble salt of acetic acid containing combined but undissociated acetic acid derived by replacing water in an acetate salt with acetic acid, and fluoboric acid dissolved in water, the weight ratio of F to CrO_3 being within the range from 0.44 to about 2.2, the quantity of said complex salt being at least 0.1 gram per liter solution, and the pH being within the range from 1 to 2.

Plating Interior Surfaces

*U. S. Patent 2,859,157. Nov. 4, 1958.
J. S. Curtiss, Jr.*

A method of electroplating the interior surface of an aperture in a conductive material object comprising the steps of locating an anode adjacent the center of the cross sectional area of the aperture, directing plating current obliquely toward said object from said anode, shielding said interior surface at an area displaced longitudinally from said anode, traversing said anode and said interior surface shield together to maintain a given effective area of surface to be plated while progressively plating the entire interior surface to be plated.

Vapor Degreaser

*U. S. Patent 2,860,088. Nov. 11, 1953.
L. E. Plassmeyer, assignor to Phillips Mfg. Co.*

A degreasing apparatus comprising a tank having a bottom and side walls, a partition positioned between the side walls in the lower portion of said tank and dividing said lower portion into two, liquid-tight sumps called respectively a vaporizing sump and a settling sump whereby the latter sump may overflow the partition into the vaporizing sump, a heating element in the vaporizing sump, and an imperforate and removable drain plate positioned over the vaporizing sump and draining into the settling sump whereby solvent dripping from the work will collect in the settling sump.

Plating on Molybdenum

*U. S. Patent 2,859,158. Nov. 4, 1958.
G. R. Schaefer, assignor to the United States of America*

A process for coating molybdenum with a diffusion alloy which consists of depositing sequentially a layer of chromium about .00025 inch thick and a layer of nickel about .00075 inch thick, repeating said sequence of depositions a plurality of times, and then heating the coated molybdenum for 4 hours at a temperature above 980°C. and substantially below the melting point of the eutectic of the metals.

Bright Copper Bath

*U. S. Patent 2,859,159. Nov. 4, 1958.
C. J. Wernlund, assignor to Elechem Corp.*

An aqueous bath for electrodepositing bright copper containing about 5-20 oz./gal. of copper cyanide, about 0.010-0.20 g./l. of trivalent antimony supplied as a soluble salt thereof, and a metal chosen, in the respective proportions specified, from the group consisting of: 0.056-2.32 g./l. of zinc, 0.760-7.60 g./l. of arsenic, 0.003-0.32 g./l. of cobalt, 0.088-0.40 g./l. of iron, and 0.007-7.00 g./l. of cadmium.

Testing Apparatus for Electrostatic Coating Material

*U. S. Patent 2,859,615. Nov. 11, 1958.
G. Osame.*

An electrostatic coating material testing apparatus comprising a cylindrical drum for holding perpendicular a plurality of recording papers around the inner surface of the wall thereof, a high potential source for establishing an electrostatic field to cause the sprays of atomized particles of respective specimens to be respectively deposited upon a predetermined portion of the surface of each of the recording papers, forming thereupon respective patterns specific to each of the liquid coating materials employed, the uniformity of said patterns being dependent upon the predetermined volume of the specimen to be used and the distance between the inner surface of the wall of the recording paper holding cylindrical drum and the sharp-edged fringes of the specimen holding grooves.

Bright Cyanide Zinc Bath

*U. S. Patent 2,860,089. Nov. 11, 1958.
J. L. Jackson, assignor to R. O. Hull & Co., Inc.*

In the process of electroplating zinc,

the step of depositing zinc from an aqueous cyanide zinc bath containing an addition agent comprising 0.04 to 0.4 gram per liter of polyvinyl alcohol and from 0.1 to 1.0 gram per liter of a bath soluble polyepoxyamine resulting from the condensation reaction of epichlorhydrin with a primary amine.

Electropickling Process

*U. S. Patent 2,860,092. Nov. 11, 1958.
A. L. Hart and G. G. Kamm, assignors to American Can Co.*

A method of high speed cleaning and deoxidizing the marginal edge portion of a ferrous can body blank, comprising passing said portion between induction heating coils having an induction frequency of from 100 to 500 kilocycles, heating said portion to a temperature of about 525°F. in about 0.4 second by means of said coils, immersing the thus heated portion in an aqueous HCl solution for about 3 seconds, said solution containing about 18% by weight HCl and being maintained at a temperature of about 120°F., making said can body blank one electrode in an electrochemical circuit, and passing an alternating current having a current density of about 1500 amperes per square foot through said solution whereby said portion is cleaned and deoxidized by an electropickling action.

Acid Cleaning Composition

*U. S. Patent 2,860,106. Nov. 11, 1958.
L. L. Little and G. Chen, assignors to E. F. Drew & Co., Inc.*

An acid cleaning composition comprising a mixture of the crystalline addition product of urea and phosphoric acid, said product having a pH below 4.7, the ratio of urea to concentrated phosphoric acid by weight being about 1 to 2, with a wetting agent taken from the class consisting of quaternary ammonium cationic wetting agents and polyglycol ether non-ionic wetting agents having 10 to 100 glycol radicals.

Organic Coating

*U. S. Patent 2,860,110. Nov. 11, 1958.
H. W. Godshalk, assignor to E. I. du Pont de Nemours & Co.*

A pigmented coating composition, which produces a dry coating characterized by uniform pigment dispersion and by the absence of pigment flooding and mottling, comprising a polymer of methyl methacrylate as the preponderant film-forming material, volatile sol-

vent therefor, plasticizer therefor, pigment and about 0.1—10%, by weight, based on the total weight of non-volatile constituents in said coating composition, of a cellulose ester selected from the group consisting of cellulose nitrate, cellulose propionate, cellulose butyrate, cellulose acetate butyrate, cellulose acetate propionate, and mixtures thereof.

Organic Coating

*U. S. Patent 2,860,118. Nov. 11, 1958.
R. Nagelschmidt and A. Rudolph, assignors to Deutsche Gold-und Silber-Scheideanstalt vormals Roessler.*

A corrosion preventing coating composition for metals comprising a chlorine containing organic polymer selected from the group consisting of chlorinated rubber, polychloroprene, chlorosulfonated polyethylene and copolymers of vinyl chloride and vinyl acetate as a film former, a copper compound selected from the group consisting of copper oxide and its hydrate and a tertiary organic heterocyclic base containing a six membered nitrogen containing heterocyclic ring selected from the group consisting of pyridine, picoline and quinoline.

Tumbling Barrel

*U. S. Patent 2,860,456. Nov. 18, 1958.
C. L. Bergman, assignor to Kemiska AB Candor.*

Apparatus for carrying out wet tumbling operations such as wet scouring, ball polishing, barrel nickel plating or the like in which work pieces are acted upon by a bath as well as by the abrasives included therein, said apparatus comprising a liquid vessel, a barrel rotatably mounted above and extending at least partially into said vessel, a filter placed in said vessel to provide an approximately vertical partition separating a first portion of said vessel into which said barrel extends from the remaining portion of said vessel, a pumping device arranged to convey liquid from said first portion of said vessel to the interior of said barrel, said pumping device comprising a plurality of compartments along the periphery of said barrel with holes in each of said compartments communicating with the exterior of said barrel and conduits leading from each said compartment to the interior of said barrel at a point near the axis of said barrel, said barrel having at least one opening near the axis thereof and means for causing the liquid flowing from said

opening to flow into said remaining portion of said vessel.

Electrostatic Spray Process

U. S. Patent 2,860,599. Nov. 18, 1958.
J. H. Rice and V. R. Johnson, assignors
to Binks Manufacturing Co.

An electrostatic spray device for coating the surface of an object with a liquid coating material which comprises, a stationary spray electrode comprising a pair of opposed substantially disc-shaped members one of which has an arcuate relatively sharp edge portion.

Ultrasonic Cleaner

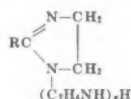
U. S. Patent 2,860,646. Nov. 18, 1958.
J. Zucker.

A particle cleaning apparatus comprising, in combination, a receptacle defining a closed cleaning chamber adapted to receive a liquid; support means for supporting in said cleaning chamber and under the level of a liquid received therewithin particles to be cleaned; generator means for producing supersonic waves in the liquid, thereby subjecting to supersonic waves particles supported by said support means in said cleaning chamber below the liquid level of the liquid; and means communicating with said cleaning chamber which is above the liquid level of the liquid.

Rust Preventive Composition

U. S. Patent 2,860,996. Nov. 18, 1958.
M. J. Furey, assignor to Esso Research
and Engineering Co.

The method of improving the storage stability of cutback asphalt-base thin film rust preventive composition which comprises blending with said compositions a minor but viscosity-stabilizing amount of wax amine compound having the formula



wherein R is a monovalent saturated hydrocarbon radical having from 40 to 80 carbon atoms and wherein x is a number of from 1 to 2.

Porcelain Enameling Gold

U. S. Patent 2,861,010. Nov. 18, 1958.
G. J. Axelrod and H. Axelrod.

A process of bonding porcelain to a casting of gold or gold alloys comprising applying successive layers of porcelain containing powdered gold or gold

alloys upon the casting and separately baking each layer on the preceding one before the next layer is applied, the metal content of the porcelain progressively decreasing from the innermost to the outermost layer, the metal content of the innermost layer being approximately 0.1% by volume.

ABSTRACTS

Rust-Protection by Lanolin Coatings

Kemikalijacket (Sweden), 16, No. 8, 206.

Compounded mixtures containing lanolin, can usefully be employed for the protection of iron and steel. The following formula is recommended:

Hard rosin	2 kg.
Lanolin	3 kg.
Xylol	1 litre
Solvent naphtha	4 litres
Zinc chromate	2.5 kg.
Kaolin	1 kg.

Although this coating mixture air-dries, better and more rapid drying and adhesion are obtained if the coating is dried-off for 15-30 minutes at 105-110°C.

New Method for Titrometric Estimation of Sulfuric Acid in Chromium Plating Baths

R. Decker; *Galvanotechnik*, 49, No. 6, 227-30.

Up to the present, three analytical methods have been utilized for the determination of sulfuric acid in chromium acid in chromium baths. These are: 1. Precipitation by barium chloride and weighing the barium sulfate precipitate; 2. Precipitation as above and centrifuging; 3. Reduction of the sulfuric acid to H₂S which is distilled off and weighed gravimetrically. The first and third methods are too long and require a considerable equipment; the second method is simpler but less precise.

The new method comprises a back titration, after precipitation of the sulfuric acid by barium chloride. A known volume of standard barium chloride precipitates, in an ammoniacal solution of pure chromate, a known quantity of barium chromate. This precipitate which is filtered and carefully washed, is dissolved in cold dilute HCl. Potassium iodide is added,

and the liberated iodine is titrated with Na₂S₂O₃ in the presence of starch-amidon until the blue color disappears.

If the same quantity of barium chloride is added to a chromate solution containing sulfuric acid, a precipitate of barium sulfate is also obtained and the chromate precipitated will be proportionately less.

The results obtained are comparable to those obtained gravimetrically. The bath impurities such as Fe⁺⁺⁺, Cr⁺⁺⁺, and Al⁺⁺⁺ are sequestered by the addition of citric acid to the solution. Cu⁺⁺, Ni⁺⁺, Zn⁺⁺, Mg⁺⁺, Co⁺⁺, Cd⁺⁺, remain in solution in the presence of a sufficient quantity of ammonium salts. Certain anions (HF, H₃PO₄, H₂SiF₆) should be eliminated in advance.

Phenomena Occurring During Electropolishing of Aluminum and Steel

E. Lichtenbergerne; *Korrosios Napok* (Hungary), No. 122, 533 (1958).

For the purpose of studying the electropolishing procedures of aluminum and iron, the changes of the anode potential, which occur during the polishing treatment, were investigated. A normal Hg/Hg₂SO₄/H₂SO₄ measuring electrode was used. Depending on the quality of the steel being electropolished with an anode current density of 5-8 amp./dm.², there occurs a sudden change of the anode potential.

It was found possible to remove a passivating film from the surface of the electropolished steel by the Evans method. The passivation occurring during electropolishing was also measured by the change of the electrode potential of the metal. The presence of the passivating film could also be followed by the measurement of capacity and the resistance of the coating. By means of the Hunter barrier-layer investigation, there was measured on stainless steel a barrier layer of 20 Å. On non-alloy and low-alloy chromium tool steels, no dense barrier coating of this type could be found after electropolishing.

The characteristics of the curves obtained in electropolishing aluminum are similar to those obtained in polishing steel. The difference consists in the fact that the boundary current section is longer. The character of the anode potential curves is dependent on the composition of the metal and the bath as well as on the temperature. Passi-

vating films are formed at the surfaces of electropolished aluminum, of varying composition and thickness, according to the composition and temperature of the bath.

The Sendzimir and Cook-Norteman Continuous Hot-Dip Galvanizing Process for Steel Sheet

T. Sendzimir: Paper read at the 5th International Galvanizing Congress, Holland.

In the Sendzimir process, it is usual to add small amounts of aluminum to the zinc bath for pre-alloying at short intervals. It is important to maintain the aluminum content in the bath at a constant figure. The determination of the aluminum in the zinc bath can be made by a spectrographic method, within a few minutes.

The Sendzimir galvanizing method is a full-automatic procedure, as the cold-rolled steel strip passes directly from the rolls, through the various stages, to the galvanizing station. A special advantage is the good formability of the galvanized sheet. This permits producing holloware directly from the galvanized flat steel sheet by means of deep drawing.

It was stated by Cook, who developed the Cook-Norteman process, that the aluminum content can be varied in the bath with this process. It is possible to obtain thin zinc coatings as well as thick ones (up to 900 g./m.²). It is also possible to remove completely any residual fluxing medium with the newer equipment.

In practice, it has been found in the Sendzimir process that, with the addition of about 0.2% of Al, about 0.1% Al is retained in the bath.

Corrosion Resistance of Galvanized and Painted Steel

P. Morriset: Paper read at the 5th International Galvanizing Congress, Holland.

The author reported on corrosion tests conducted on plain galvanized and on galvanized and painted steel sheets. The salt spray test, and what is termed the Industriebau test, were employed. The galvanized test sheets were selected from a great number of commercial sheets and had zinc coatings of from 200 to 900 g./m.² on both sides. The paint systems tested consisted of zinc dust paints, solutions on a bitumen basis, wash primers, as well as drying oil paints. In some cases, 1

and 2 coat paint finishes were tested. In the paper, the damage suffered during the corrosion tests was clearly shown by color photographs.

The results of these investigations on zinc-coated sheets confirmed the relationships between the zinc coating and the corrosion resistance. With the painted parts in the salt spray test, the zinc and the paint were attacked simultaneously. In the Industriebau test the paint coating was destroyed before attack on the zinc coating had become visible.

The tests proved the great advantages of the zinc coating, as compared with unprotected steel, as a base for a paint coating. None of the combined zinc and paint coatings showed even partial damage after more than 80 cycles in the Industriebau test. It is obvious that certain paints must be used in combination with galvanized steel sheet. In France, it has been found that non-painted steel sheet with a zinc coating of 400-500 g./m.² provides sufficient corrosion protection.

It was mentioned that testing with a 20% sodium chloride solution in the salt spray test is unfavorable for zinc and that it is better for other quick-test processes to be applied. It is also fairly important, as regards behaviour, whether the galvanized steel sheet has been phosphated prior to painting. This provides a better surface for the subsequent paint coating.

SCIENCE FOR ELECTRO-PLATERS

(Continued from page 74)

addition of ammonium nitrate. The change is attributed to the simultaneous reduction of the nitrate ion and copper ion. Another observation made was in the ability to use higher current densities in acid copper baths, before hydrogen is liberated, when ammonium or sodium nitrate is included in the bath, an indication of preferential reduction of the nitrate ion to that of the hydrogen ion.

The formation of complex ions with copper and positively charged addition agents, such as metaphosphoric acid, tartaric acid, and glycol (based upon c.m.f. and ion migration experiments) was reported by G. Fuseya and K. Marata. The general classification, including oxy-acids and amino acids, the authors indicate, possesses the property of forming complex cations with copper ions. Sugars and higher alcohols, however, did not form complex ions with copper. A relationship, it is

suggested, exists between the aforementioned property of complex ion formation with some addition agents and reduction in size of deposited crystals.

In an effort to eliminate waste and expense associated with the loss of electrodeposited copper due to buffing operations (which in auto production in 1942, according to F. L. Clifton and W. M. Phillips, represents at a minimum estimate, a loss of 10 ounces of copper per car), an investigation of the use of brighteners for acid copper baths was started. Thiourea, the authors found, when added in small amounts, produced a controllable bright deposit of copper.

A secondary or supplementary addition agent, one which would overcome pitting or streaking, when used with the thiourea, permitted a wide range of current density in producing a deposit of uniform brightness. The addition to the bath of the salt of a sulfonated ether, a surface-active agent, and thiourea, gave a soft semi-bright copper deposit. Such an undercoat for nickel, it was found, requires more of a wipe than a buff, so that fewer wheels are required for automatic buffing and, with less pressure applied, a general saving results.

Buffing operations heretofore removed 0.0001-0.00014" of copper. This represented a complete loss. The composition of the bath was given as follows: copper sulfate crystals, 250 g./l.; sulfuric acid, 10 g./l.; Triton 720, 0.20 g./l.; thiourea, 0.01 g./l.; temperature 70°-80°F.; current density 48 amp./ft.². Agitation is recommended.

When molasses was used as a secondary addition agent, a bright deposit which did not require buffing was obtained. Another effect produced was the reduction in striations in low current density areas. The simple expedient of introducing a filter aid and adding the indicated quantities of thiourea and molasses permitted the conversion of the acid copper baths to bright plating baths in bumper bar and guard production.

The following formula was recommended: Copper sulfate crystals, 210 g./l.; sulfuric acid, 30 g./l.; molasses, 0.80 g./l.; thiourea, 0.04 g./l.; temperature 70°F.; Current density 70-75 amp./ft.². More than 0.04 g./l. of molasses, it was noted, may result in orange peel and striations in low current density areas.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT
FOR THE METAL FINISHING INDUSTRIES



Duplex Chromium Plate

Metal & Thermit Corp., Dept. MF, Rahway, N. J.

A new duplex chromium process consists of the successive application of two different types of bright chromium plate. The first chromium provides especially good covering and throwing power to plate more uniformly even in hard-to-reach recesses; the second builds up the total thickness of chromium to as much as 100 to 200 millions of an inch — or approximately 10 times what previously has been considered the maximum permissible.

An initial application of bright crack-free CF-520 chromium is deposited for optimum coverage and buildup in low current density areas, followed by a second bright deposit of finely cracked chromium from a specially operated CR-110 bath.

When a finely cracked chromium is deposited on top of the crack-free chromium, there results a very low rate of corrosion, or none at all. This is because the many cracks over the entire surface disperse the cell action over a large area. Therefore, there is a substantial reduction of the current density at each of these many individual openings. This keeps the current density below the value corresponding to the critical potential required for the

anodic perforation of the underlying metals. While a single thick layer of crack-free chromium upgrades corrosion protection significantly, a second deposit of finely cracked chromium has been found to provide even greater benefits.

SRHS Special CR-110 chromium has also been applied over ordinary chromium, but only with limited success. This combination is not as effective because ordinary chromium deposits do not have the ability of CF-520 to provide better coverage and freedom from cracks in deposits thicker than 0.01 mil.

It is more difficult to protect zinc-base die castings than steel, due to the fact that they contain more voids and imperfections. Plating baths cannot bridge all the surface imperfections. However, this new duplex chromium process is producing improvements of 100 per cent or more in corrosion resistance on regular production run die castings, it is claimed.

The manufacturer also states that this new process can be adapted to most existing production plating operations with minor modifications. Possibilities also exist for thinner undercoats of copper and nickel, indicating actual potential cost savings over previous practice.

0.01 MIL ORDINARY CHROMIUM

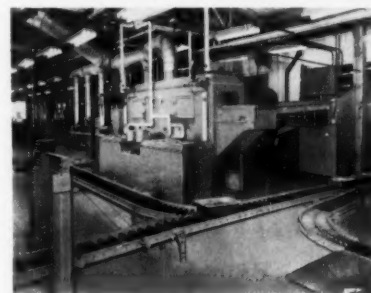
0.20 MIL DUPLEX CHROMIUM



The photo on the left shows a steel part after 48 hours in the copper-accelerated salt spray test. The part on the right is shown after 325 hours in the test chamber. Both parts have undercoats of 0.4 mil copper and 0.8 mil nickel.

Automatic Washer

Frederic B. Stevens, Inc., Dept. MF, 1808—18th St., Detroit 16, Mich.



The Panhandler can handle a cycle of seven different steps including loading, unloading, washing of parts and tote pans, return of dry pans to loading station and delivery of refilled pans to proper departments. A single operator can direct and monitor the machine and its related equipment through all seven steps.

Steel Electrocleaner

Enthone, Inc., Dept. MF, New Haven, Conn.

Enbond Cleaner FE-84 is designed for high current density, anodic cleaning of steel without danger of pitting or rusting of the work in the areas of highest current density. It rapidly removes smut, oil and solid dirt and produces a clean, water-break free surface.

The cleaner is furnished as a free flowing, dustless powder which is pleasant to handle. It is dissolved in water at concentrations of 8 to 12 oz./gal. and operated at 180 to 200°F. Since it is anhydrous and 100% active with no built-in water, it gives maximum results at minimum concentrations. High current densities of up to 100 amp./sq.ft. can be attained at average operating voltages to promote more rapid cleaning and smut removal. The cleaning solution has very high tolerance to dragged-in buffing compound which shortens the life of many electrocleaners, it is claimed.



**UP
DOWN
SIDEWAYS**

FLEXIMATIC

IS THE ULTIMATE
IN LOW-COST PROCESSING CONVEYORS

It's the ultimate in low-cost flexibility because it can include Dial-A-Cycle, Select-A-Cycle, delayed set-down, advanced pick-up, vertical oscillation, automatic load-unload and other big-conveyor features. Each of these features can be added very quickly and easily.

The *Fleximatic* is a return type processing, electroplating or anodizing conveyor.

The gross load for one carrier is forty pounds, work and rack. The rack size is a maximum of 18 inches in the direction of travel, 14 inches thick, and 36 inches long with a 9 inch hook. The machine requires a head room of 9 ft. 3 inches and floor space (width) 102 inches wide with 30 inch tanks. The length of the machine can vary to suit any particular application. The shipping dimensions of the machine are 8 ft. 2½ inches high by 7 ft. 6 inches wide. For short machines it will be possible to ship as one unit.

The minimum immersion time of the *Fleximatic* is six seconds. You can see *Fleximatic* operating at Matawan. Hanson-Van Winkle-Munning Company, Matawan, New Jersey. Offices in principal cities.



H-VW-M

Progress in metalfinishing through
advanced processes • equipment.

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Acid Cleaner

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

A new acidic detergent which combines excellent cleaning, smut-removing, and prepaint-conditioning properties, Compound No. 86, simultaneously cleans and improves steel's resistance to corrosion and receptivity to paint. It is particularly useful as a precleaner to improve phosphate coatings. It is also an effective cleaner for brass, aluminum, zinc, and terne plate.

The compound is recommended for use in spray washing machines, in a three-stage operation, and may also be used in tank immersion operations.

Transparent Corrosion Cabinet

The G. S. Equip. Co., Dept. MF, 15583 Brookpark Road, Cleveland 35, Ohio.

All-over transparency is a visual aid factor for observing tests in progress without opening this new cabinet, interrupting process or disturbing specimens. Cabinets are all-welded H-T Plexiglas and uniformly heated throughout by full-coverage water jackets (cabinet within a cabinet). Eliminated are all dangers of "hot bottom" and secondary galvanic acceleration of corrosion. All temperatures held to $\pm 1/2^\circ\text{F}$.

Controls are located at one end for convenience. The test chamber is free of metal parts or other contaminating materials. Also featured is removable salt reservoir and cover. Cabinet lid is lightweight, transparent, and has cam-type (non-fastening) gravity "hinges," front and back, for easy manual opening from either direction, or for lifting off entirely. The complete unit is lightweight and portable for adapting to any layout and is furnished fully assembled, ready for operating.

Important options are: automatic



The most efficient, most trouble-free



bubble tower liquid level control with strainer, complete air compressor equipment, and full kit of cabinet exhaust accessories. Operating currents are 110 V or 220 V/single phase/3.5 KW. (optional) 220 V, 440 V. or 660 V/3 phase/ with 110 V control.

Stop-Off Coating

Consolidated American Services, Inc., Dept. MF, 9999 Jefferson Blvd., Culver City, Calif.

A new protective coating will seal metal and stainless steel surfaces against plating, pickling, and passivating solutions, it is claimed.

CMS-N-202 is black in color, and can be applied by brush, spray gun, stencil, dip, or any other conventional

method of application. The coating requires no mixing and no additives, is ready for use as it comes from the container, is safe to use, and can be stripped off very easily when desired. It is packed in commercial size containers: 5 gallon cans and 55 gallon drums.

Stainless Steel Burnishing Compounds

Patclin Chem. Co., Inc., Dept. MF, 11-23 Casimir Ave., Yonkers, N. Y.

#520 stainless steel burnishing compound incorporates the newest concepts of chelation, lubrication, and buffered pH, to develop high lustrous finishes. Work develops a higher luster faster, without scratching, darkening, or developing any smuts that necessitate

paint-supply system ever devised!

Compare for yourself! No other method can match these important benefits of the DeVilbiss pressure-feed system.

- 1 **DEPENDABILITY!** Delivery is always consistent, and not dependent on proper functioning of pumps and other mechanical devices.
- 2 **EFFICIENCY!** Direct-applied pressure eliminates pump or booster mechanisms that take extra power to operate.
- 3 **LOW OPERATING COST!** Requires less air than any other type pressure-supply system.
- 4 **FOOLPROOF OPERATION!** No moving parts to wear, bind up, or get out of order.
- 5 **ACCURATE ADJUSTMENT!** Sensitive regulation of direct-applied air pressure guarantees more accurate control throughout wider range of pressures.
- 6 **DURABILITY!** One-piece, galvanized boiler-plate shell has no wear-out.
- 7 **UNIFORM FLOW!** The steady force of static pressure is unmatched for delivery with absolutely uniform flow rate.
- 8 **NO PULSATION!** No pumping action to set up surge and cavitation cycles.
- 9 **EASE OF CLEANING!** Simple, seamless container; full-open top; no complicated mechanism.
- 10 **LOW COST!** Initial purchase is less. Maintenance is negligible.

DeVilbiss Pressure-Feed Tanks are full-drawn from one piece of $\frac{1}{4}$ " boiler-plate steel, and galvanized inside and out. Heavy, pressed-steel lids seal with a tough synthetic gasket; are secured by rugged, forged-steel clasps. Built to A.S.M.E. specifications. Sizes: 2, 5, 10, 15, 30, and 60 gallons. Additional sizes (up to 175 gallons) and special types available.

If you want the simplest, most practical means of delivering material under constant pressure, see your distributor for a DeVilbiss Pressure-Feed Tank.

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DUST COLLECTORS • INDUSTRIAL POWER WASHERS • FLOW & DIP COATERS • SPRAY BOOTHS
OVENS • AIR COMPRESSORS • SPRAY EQUIPMENT • HOSE & CONNECTIONS • MIST COOLANT UNITS

further cleaning or tumbling operations.

The burnishing compound is used at a concentration of 1-2 ounces per gallon of water, in either a wooden barrel or in a lined steel barrel, and can be used either with shot or in a self-rolling operation. It is shipped in 425 pound drums.

Flat Polisher

Murray-Way Corp., Dept. MF, Box 180, Maple Road East, Birmingham, Mich.

The Junior Flat Polisher is designed to grind, polish and deburr flat surfaces of material with cross sections up to 12" by 4". These machines will handle material in coil, sheets, bars,

blanks, manufactured or cast parts, using an abrasive belt for either wet or dry operation. They can be arranged in tandem to perform consecutive polishing operations, and are available in models which can be fed by conveyor, pinch rolls, or coiling equipment.

Belt tension and oscillating idler roll pressure are held constant by automatic air control, providing a uniform finish and longer belt life. Continuous, 111" long abrasive belts in widths from 6" to 12" can be used. A hand wheel on the outside of the unit enables quick, easy adjustment for changes in work thickness. Abrasive belts can be changed quickly by means of a manually operated air valve. An ammeter, mounted for easy viewing, shows the operator the motor load at a glance,



and the Neoprene contact roll can be dressed right in the machine at operating speeds.

Phosphating Cleaner

Fine Organics, Inc., Dept. MF, 205 Main St., Lodi, N. J.

In addition to passivating and phosphating all types of metals, water-soluble acidic solvent, F.O. 190 keeps weight loss to a minimum, which is particularly important in close tolerance. According to the manufacturer, F.O. 190 removes oil, rust and corrosion in one operation, providing a corrosion-resistant surface for uniform, permanent paint adhesion. It also removes the usual rust preventives, identification inks, stamping oils, carbon smuts, and other soils.

The product does not need additive compounds, special equipment, or heating. It is non-flammable, has no unpleasant odor, and can be used in four ways: brush, swab, spray and dip.

Carbon Dioxide Extinguishers

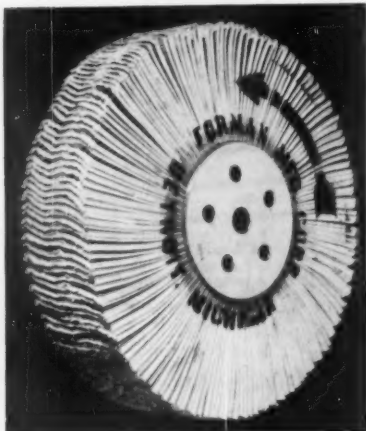
Walter Kidde & Co., Dept. MF, Belleville, N. J.

Three carbon dioxide portable fire extinguishers featuring new hose and discharge nozzle assemblies have been awarded highest Underwriters' Laboratories ratings for their respective capacities. Units are of 10, 15, and 20 pound capacities and are available in either trigger or squeeze valve actuating mechanisms. The portables are rated at 8B:C, 10B:C, and 12B:C respectively.

The manufacturer is offering the new hose-horn assemblies as a replacement item for its 10, 15 and 20 pound carbon dioxide portables already in the field. The new horn assembly is easily screwed into older extinguishers and automatically upgrades their fire smothering ability. New brackets are also provided.

Buffing Wheel

Formax Mfg. Corp., Dept. MF, 3171 Bellevue, Detroit 7, Mich.



A new buffing wheel is now being marketed under the trade name "No-Streak." According to the manufacturer, production users are reporting this new and unique construction, mounted on re-usable flanges, increases normal buff life by as much as 300% while providing improved cut and brighter, streak-free finishes, due to the fact that the flat-type construction contains more cotton sheeting per square inch of wheel face, holds a better head of compound, and is self-cooling. Further, since extreme pressures are not required to secure maximum wheel efficiency, buff fraying and compound consumption are greatly reduced.

These wheels are currently available in all cloth, or in cloth and sisal constructions, and in diameters from 14" through 22", in face widths from 2" through 6".

Paint Heater Hose

DeVilbiss Co., Dept. MF, Toledo, Ohio.

The new hose utilizes butyl water tubes on each side of the material hose with all three contained in a rubber jacket. Use of the tubes instead of channels within the jacket makes possible better seals at the heat exchanger and at the U-tube connection which returns the water for re-circulation.

Because of the variety of materials sprayed, by gun and by atomizer, the rubber in tubes and bulbs has to withstand attack by a number of chemicals. To meet these problems, the manufacturer selects its own rubber and reinforcing materials to build components for company products.

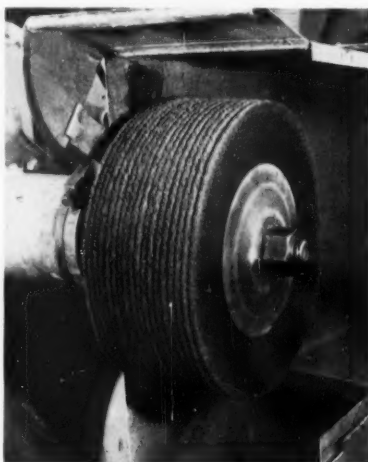
Bonded Abrasive Discs

Minnesota Mining & Mfg. Co., Dept. MF, 900 Bush Ave., St. Paul 6, Minn.

A new material that is claimed to produce a unique finish on fabricated metals at lower cost than other finishing methods, "Scotch-Brite" brand finishing material is made of nylon web impregnated with fine grades of abrasive mineral. It is not intended for stock removal.

The finish generated by the material is unique, and cannot be compared to any other, even the maze of so-called "satin finishes" for which there is no set standard. In addition to fine finishing, indications are strong that the use of the material prior to and during pickling operations cuts pickling time and produces cleaner steel.

Suitable for use on automatic, semi-automatic, hand-held and hand opera-



tions, the new material replaces buffing and polishing compounds for some final finishing. It is lightweight for easy use with portable tools. Finishes generated by the new material at the mill or at the fabrication plant, which may be damaged slightly or scratched in shipping and assembling, can easily be blended on-the-job.

The material is supplied in disc form, and is about 1/4" thick. Five discs combine to make a loading approximately 1" wide. The discs can be ganged on a common spindle to any width, with the widest commonly being that of a 60" steel sheet.

The product is available in 6", 8", 10", 12" and 14" discs, in four types: very fine, fine, medium and coarse.

Degreasing Agent

Electro-Chemical Prod. Corp., Dept. MF, 427 Bloomfield Ave., Montclair, N. J.

No-Tox is a new degreasing agent with characteristics similar to carbon tetrachloride, but said to be one hundred times safer.

The new product has the same MAC rating as isopropyl alcohol, dries quickly, is completely non-flammable, has low toxicity, and can be used in any type of degreasing operation with the exception of vapor phase degreasing.

Phosphorescent Paints

Ultra-Violet Prod., Inc., Dept. MF, San Gabriel, Calif.

High quality phosphorescent paints that charge themselves from natural or artificial light during the day so they can glow in nighttime darkness are manufactured in both baking and air dry formulations. They have good gloss retention and will reactivate themselves indefinitely. Baking type is used primarily on metal surfaces, while air is designed for materials such as wood, paper, plastics and plaster. White primer undercoat and a clear finishing varnish is recommended for maximum results, according to the manufacturer.

Hot Spray System

Spee-Flo Co., Dept. MF, 6614 Harrisburg Blvd., Houston 11, Texas.

An all new package for the heated application of coal-tar and asphaltum type materials is specially designed for heavy-duty work at high pressures. It includes the new Atlas pump, Power-mastic heater and a heavy materials gun.



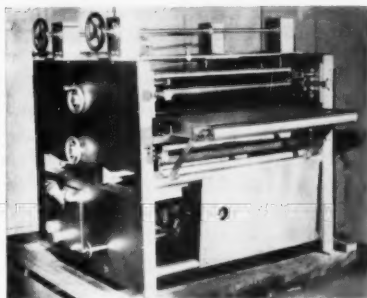
The pump is 10 to 1 ratio, double action and is powered by a heavy-duty 4 1/4-inch air motor. It will deliver up to five gallons per minute at 1000 psi. An added feature is the Stedi-Flo valve which removes pressure from the fluid line when the gun is not in use. This prevents surge and extends the life of the equipment.

A dual 4 kw heating unit and a working pressure rating up to 1500 psi gives the new heater more power and twice the pressure capacity of any previous heater. Featuring an all manganese-bronze fluid section, the unit is ruggedly built and compact.

Completing the package is the new Model 701A heavy materials gun. This gun has been specially designed for the handling of mastics and heavy materials. It features twin regulation for complete control of both atomizing and material pressure.

Roller Coater

Union Tool Corp., Dept. MF, Warsaw, Ind.



A new roller coater coats top and bottom surfaces twice in a single pass. Known as the "Two-Stage Twin" roller coater, this unit has two double coating assemblies located on 18" centers. Flat stock is fed into the unit by conveyor and a second conveyor moves it from the first coating section to the second. Variable speed drive controls the feed rate. A circulating pumping unit regulates the amount of coating material to the crotches of the upper rolls and the feed pans on the lower rolls.

Upper rolls are individually adjusted by handwheels; two gear-elevating mechanisms keep them in parallel throughout the range from 0" to 2". Two additional handwheels move the doctor rolls toward and away from the coating rolls to assure extremely fine adjustment of coating thickness.

The two front doctor rolls are equipped with micrometer-type hand

TWO TESTS SHOW Redline[®] BUFF CLOTH GIVES UP TO 20% INCREASE IN BUFF LIFE

Test I — Square aluminum skillets—Semi-automatic machine 20" x 7" center 18 ply.
REDLINE performed well with the same compound used on unbleached cloth.
Continued to cut well, to a smaller diameter than the previous cloth. About a 20% increase in buff life.

Test II — Aluminum shower door strips—Hand buffing 16" x 7" center 16 ply.
REDLINE cuts better, was stiffer than unbleached 86/93 Company claimed that REDLINE lasted twice as long.

Results!! To what extent has Redline been successful? In the last six months over one half million yards of Redline has been purchased by buff manufacturers. Buffs of Redline cloth are being used in plants throughout the country on work ranging from silver to zinc die castings.

Perhaps you would like to check Redline's cost/performance ratio in your own buffing operation? We suggest that you ask your buff supplier to prepare a test lot of buffs made with Redline cloth in the size and design you need. In this way you can check Redline yourself to see how it can improve your buffing performance.

Redline is a trademarked fabric. Together with Types 160, 190 and Wearon, it comprises the Milliken line of "Fabrics Engineered for Buffs".

DEERING, MILLIKEN & Co., Inc.
1045 SIXTH AVENUE • NEW YORK 18, N.Y.

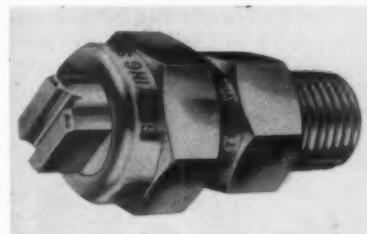
knob adjustments for precision metering. Viscosity is controlled by means of an immersion heater in the supply tank which keeps material at room temperature at all times.

The roller coater is simple, compact and easy to operate. It can be used to coat any flat sheets with any type of fluid material, and is available in 14" to 72" widths.

Atomizing Nozzles

Spraying Systems Co., Dept. MF,
3245 Randolph St., Bellwood, Ill.

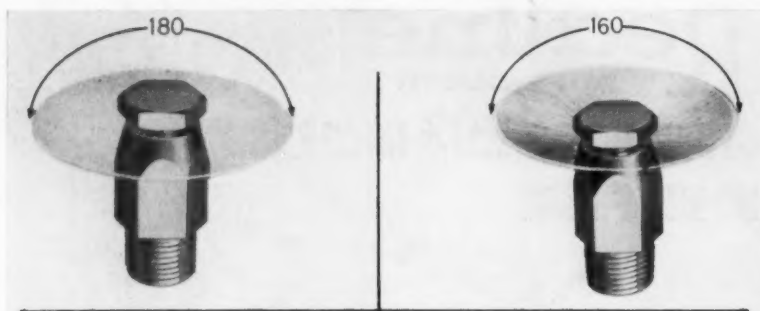
The 0011 series, for operations requiring exact control at extremely low volume, are believed to be the smallest capacity hydraulically operated flat spray atomizing nozzles ever designed.



At 40 pounds pressure, rated capacity of these nozzles is two-thirds gallon per hour. A choice of three different spray angles is available. The nozzles are precision made with orifice dimensions equivalent to a 0.009" diameter. Advantage of these new nozzles is that a high degree of uniform atomization is obtained by hydraulic pressure alone—no pneumatic connection is required.

Industrial Spray Nozzle

Wm. Steinen Mfg. Co., Dept. MF, 43 Bruen St., Newark, N. J.



A new, extra-wide angle, circular-spray nozzle for industrial applications, the Span-Jet is made in two styles to provide either a 180° flat, circular spray pattern or a 160° hollow-cone spray pattern. The nozzles are made in

capacities from 0.75 to 10 gallons per minute at 40 psi. The standard nozzles are made with a male connection to fit pipe sizes of 1/8", 1/4", and 3/8", and are available in brass, 303 stainless steel or special materials as required.

Roller Coater

Conforming Matrix Corp., Dept. MF, 349 Toledo Factories Bldg., Toledo 2, Ohio.

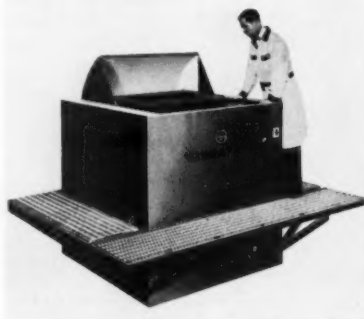
A small portable machine now uniformly coats hand transfer rollers which, in turn, transfer the color to the work with a consistent result. One roller is inked while the second is in use. Hence, a hand roller with the exact amount of material for immediate application is always ready for the operator. An outstanding feature of the machine is a speed reducer, permitting accurate control of the pick-up and distributing rollers in order to accommodate various coatings.

This small (14" x 19" x 14") air operated unit comes equipped with air filter and automatic lubrication. Diameter of rollers are predetermined so that roller circumference distance permits coating the length of the work with one pass with each roller inking. (Illustrated is an instance where rollers

of two different sizes are used alternately.) Roller pressures are readily adjustable.

Vibrating Finisher

Roto-Finish Co., Dept. MF, Kalamazoo, Mich.



The Vibratron is a newly developed machine for mass production cleaning, descaling, deburring, radiusing, fine finishing, and coloring of complex cast, forged, stamped, and machined parts with shielded and internal surfaces. Time cycles are very short with a rate of production up to 1000% greater than parts processed utilizing conventional barrel finishing techniques, it is claimed. The process is very economical inasmuch as only a few ounces of compound are necessary to do an effective job.

Unlike conventional barrel finishing where the abrasive action takes place in a sliding zone only several inches deep, the work zone in the new machine extends throughout the entire abrasive mass. Vibration is induced by a sys-

tem of eccentric weights integrally mounted within the vibrating motor. The motor is mounted directly onto the bottom of the vibrating tank. The motor is completely waterproof, and power requirements are low.

Rust Preventive

Daubert Chem. Co., Dept. MF, 4700 S. Central Ave., Chicago 38, Ill.

Fire hazards, inherent in conventional solvent-type rust preventives, can now be eliminated through the use of non-flammable Nox-Rust 920, an emulsion type product.

Free of toxic or combustible fumes, the material requires no special handling or precautions. Applied by dipping, spraying, or brushing, it dries rapidly to a firm, transparent wax coating which will protect metal up to five years indoors, and up to three months when exposed to the weather, it is claimed.

BUSINESS ITEMS

New Distributor for Narda

The new distributor for Narda ultrasonic cleaning equipment in the state of New Jersey is *C. Burwell, Inc.*, 654 Allwood Road, Clifton, N. J.

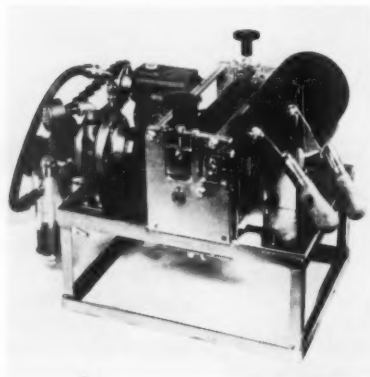
Walter T. Johnson, formerly with the Curtiss-Wright Corp., is managing this new operation. *Chet Burwell* has been, for many years, distributor to New Jersey industry for cutting tools, grinding and cut off wheels, etc., and is expanding with a newly organized Equipment Division.

Mr. Johnson has arranged for demonstrations of the equipment at the Burwell laboratory in Clifton on Fridays due to the great increase in ultrasonic cleaning activities in 1959.

International Rectifier of Canada, Ltd., Formed

International Rectifier Corp. of El Segundo, Calif., has announced the formation of *International Rectifier of Canada Ltd.*, to supply Canadian industry with a full complement of electronic-electrical components. Headquarters have been established at 1581 Bank St. in Ottawa, Ontario, with *Earl F. Johnson* as secretary-manager.

Johnson has been associated with the Canadian electronics industry in sales engineering and management capacities for several years. He is a





Earl E. Johnson

graduate in electrical engineering from the University of Manitoba, receiving a Bachelor of Science degree, and completed graduate studies at McGill University in Toronto.

Vanton Pump Creates Design Servicing Department

A new Design Service Department to help small pump users solve fluid-handling and pump problems has been announced by Vanton Pump Division of Cooper Alloy Corp., Hillside, N. J.

Prime function of the new department will be to give detailed advice on specific fluid-transfer problems.

The company has developed a communication program to maximize efficiency of the new department. It includes a technical design data folder with a return envelope requesting the recipient to fill out the details of the specific fluid-transfer situation, and send it to the factory for detailed recommendations.

Dr. Louis Schiffman Now with Amchem

Amchem Products, Inc., Ambler, Pa., has announced that Dr. Louis Schiffman has joined the firm and has been assigned to the company's Metalworking Chemicals Division. He will do research and product development work.

Dr. Schiffman came to the firm from the Atlantic Refining Co. Prior to this he was with DuPont's organic chemicals department.

Dr. Schiffman attended New York University from which he obtained his B.S. degree in chemical engineering in 1943. After graduation he worked as a research engineer for the Pennsylvania Grade Crude Oil Assn., Bradford, Pa.,



Product: 99.75+ % Pure
Service: 100% Sure

Every batch checked. Every can filled with a full weight of extra high quality 99.75+ % Chromic Acid. Prompt delivery from ample factory and nearby distributor stocks. Why not order BFC Chromic Acid next time?

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Dr. Louis Schiffman

for a period of two years and also during summer vacations. He acquired his M.S. in 1952 and his Ph.D. in physical chemistry in 1955, both at New York University.

Dr. Schiffman is a member of the American Chemical Society, the American Institute of Chemical Engineers, and the Phi Lambda Upsilon and Sigma Xi, honorary societies.

Martin Appointed by Pangborn Corporation

The appointment of James E. Martin as Cleveland district manager has been announced by Pangborn Corp., Hagerstown, Md. He will direct overall sales activities in field engineering services from the district headquarters at



James E. Martin

9802 Euclid Ave., Cleveland, Ohio, and succeeds *Robert E. Donnelly*, who recently retired after 30 years service with the corporation.

Mr. Martin has spent 14 years with the firm, starting in the home office before World War II. An Air Force veteran, Martin is a graduate of Notre Dame University, with a degree in industrial engineering. After serving as a sales engineer for a short period in Philadelphia, Pa., he was assigned to the Cleveland office in 1949. He has served as assistant district manager until his appointment as district manager.

Pittsburgh Plate Announces Paint Research Appointments

A series of appointments in the re-

search and development department of the paint division has been announced by *Pittsburgh Plate Glass Co.* *Richard T. Ubben* has been appointed division technical director succeeding *Dr. W. W. Bauer* who is working on a technical assignment overseas for Pittsburgh Plate Glass International, a wholly-owned subsidiary. Mr. Ubben transferred to the company's Springdale (Pa.) research center from the Milwaukee, Wis., paint factory where he had served as assistant division technical director for the past several years. He joined the firm in 1942 as a chemist at its Newark, N. J., paint factory.

Appointment of *Robert P. Ericson* as assistant division technical director, with headquarters at Springdale, also is announced. Mr. Ericson, formerly technical director at the company's East Point, Ga., paint factory during the past three years, joined the firm in 1941 as a chemist at Newark.

R. E. Mutzberg has been named technical director, succeeding Mr. Ericson at the East Point plant. Prior to his appointment, Mr. Mutzberg had served as head of the can coatings development department at Newark during the past ten years.

Carnehl Joins Wyandotte Chemicals Corp.

Raymond W. Carnehl is a recent addition to *Wyandotte Chemicals'* Kansas City district. He is a representative for the J. B. Ford Divisions' industrial products line.



Raymond W. Carnehl


Thoroughly familiar with the methods and production problems of many types of industrial plants and shops, Mr. Carnehl has a 10-year background of service to distributors and customers. His work has taken him into all of the north central states, and many midwestern states as well. He attended schools in Park Ridge, Illinois, and also Michigan State University, at Lansing.

Industrial Filter Names Sward and Danek

Ted Sward has been appointed assistant sales manager for *Industrial Filter & Pump Mfg. Co.*, Cicero, Ill.

Previous to his present appointment, Mr. Sward had served the company for 3½ years as a sales engineer. Before coming to Industrial, Sward was associated with Western Electric Co., Chicago. He is a graduate of James Milliken University in Deca-

DEPENDABLE



PRODUCTS

- PLATING RACKS
- RUBBER DRUM LINERS
- ACID CONTAINERS
- ANODE HOOKS
- FIBERGLAS TANKS
- DUCTS & HOODS
- PLASTIC COATED DIPPERS & PAILS
- STEEL & STAINLESS STEEL TANKS
- LEAD & PLASTIC LINED TANKS
- POLYETHYLENE PAILS & CONTAINERS
- FUME SEPARATORS
- PLATE COILS
- LEAD ANODES
- DEGREASING SOLVENTS
- SILVER BRIGHTENER

NEW • STURDY • LIFETIME PPI Titanium Scrap Saver Anode Baskets

Completely Made of Titanium Metal with Rugged Welded Frame . . . Built to Last Almost Indefinitely When Used in Nickel or Acid Copper Plating Solutions

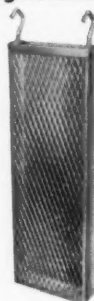
Advantages that will make you money

- Nickel and Copper anode scrap makes perfect electrical contact to titanium basket and draws full current
- Solutions have no effect on titanium metal either with or without current
- Eliminates the hazards of plating failures that occur when using plastisol coated steel baskets
- Eliminates all possibilities of iron contamination

NOTE: Titanium metal can't be used in cyanide or fluoroborate solutions

Titanium Scrap Saver Baskets are made in graduated sizes . . . write today for prices, details, and advise us of your requirements.

A Few PPI Territories Open For Distributors . . . write for details



PATENT PENDING

PLATING PRODUCTS, Inc.

1509 N. WASHINGTON
KOKOMO, INDIANA



Ted Sward



L. R. Danek

tur, Ill., where he earned a BS degree in 1951.

L. R. Danek has been named regional sales manager for the eastern area and advertising manager for the company's overall program.

Previous to his present appointment, Mr. Danek served the company as an application engineer, a post he has held for 2½ years. He was earlier associated with Swift & Co., Chicago, as a research engineer in the company's research laboratory. He received a BS degree in Chemical Engineering from the Illinois Institute of Technology in 1954.

Sol Meisels Joins Arlington Blower Corp.

Sol Meisels, formerly with *Manhattan Blower Corp.* as sales engineer for the past 12 years, is now associated with *Arlington Blower Corp.*, Brooklyn, N. Y., in the same capacity. He will be in personal charge and super-



Sol Meisels

vision of designing, fabricating, and installing exhaust and blower systems, as well as all other types of sheet metal fabrication.

Pfaudler Establishes International Division

Pfaudler Permutit Inc. has announced the creation of an international division and the selection of vice president *George C. Calvert* to direct its operation. Calvert, who has been a company vice president since 1938, is taking charge of a unit that will handle the administration, coordination and control of a growing number of plants abroad, as well as the export sales from domestic plants.

Manager of the plant in Elyria for the past 20 years, Calvert began his company service with summer work before he completed his education at Cornell University. He had full time duties in Elyria from 1924 to 1931, spent seven years in Rochester as assistant general sales manager and returned as vice-president in charge of the Elyria plant in 1938. Calvert has been a member of the company board of directors since 1942.

Amchem Promotes Russell to Chief Engineer

George Russell has been promoted from assistant to chief engineer by *Amchem Products, Inc.*, manufacturers of chemicals for the metalworking industry.

Mr. Russell, who has been with the



George Russell

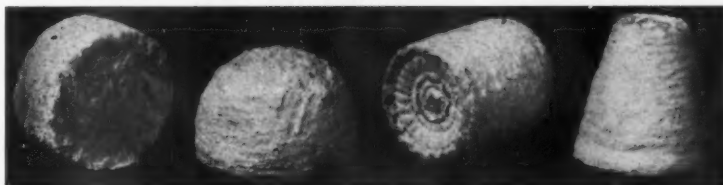
firm since 1947, is a member of the National Society of Professional Engineers and a past president of the Valley Forge Chapter of the American Institute of Plant Engineers. He succeeds *Jay Biery*, who recently retired after 31 years with the company.

Everlube Installs Plating Plant

EverLube Corp., No. Hollywood, Calif., manufacturers and compounders of dry film lubricants, announces the opening of a new plating division, located at 6940 Farndale Ave., No. Hollywood, Calif.

The division will specialize in quality plating applications in the precious metal field which will include gold,

BUFFS FOR INSIDE POLISHING



GOBLET BUFFS, TAPER BUFFS, CYLINDER BUFFS, SMALL POLISHING WHEELS, RAZOR EDGE BUFFS, and many others for deburring, polishing and grinding any internal contour.

Write for additional information or contact your local dealer. These buffs are stocked by many dealers throughout the country.

We manufacture a COMPLETE LINE OF BUFFS including full disc loose and sewed buffs and polishing wheels. Our metal center BIAS TYPE BUFF may help cut your polishing costs.

Your request on your letterhead will bring our complete catalog by return mail.

BARKER BROTHERS INC.

ESTABLISHED 1911

1660 Summerfield Street

Brooklyn 27, N. Y.

Canadian Distributor — LEA PRODUCTS COMPANY, Montreal

silver, electroless nickel, hard nickel, rhodium. In addition, this modern plating facility also will have cadmium and copper.

Promotions Announced by Diamond Alkali

Promotion of *George W. Hottel*, field salesman in *Diamond Alkali Co.'s* New York branch office, to staff assistant in the company's general sales and market planning department, Cleveland, was announced recently. Transferring to the post vacated by Hottel is *Jack G. Redmond*, field salesman at the Cincinnati branch sales office.

In 1942, following two years at Bethany College, Bethany, W. Va., Hottel enlisted in the U. S. Air Force, serving four years as an instructor in Communications. Honorably discharged in 1946, he resumed his studies, attending Columbia University, New York, N. Y.

Redmond is a 24-year company veteran whose experience centers chiefly in sales work at the Cincinnati branch office. A graduate of Robert Morse School of Business, Pittsburgh, Pa., he also attended the University of Cincinnati.

Wyandotte Chemicals Corp. Appoints Ball

Duane L. Ball was recently appointed Industrial Department representative of *Wyandotte Chemicals Corp.*, J. B. Ford Division, Cleveland district. Ball's shop experience started in the Ford Motor Co.'s Cleveland foundry. General production and laboratory work led to him becoming a foundry foreman for three years. Later, with a



Duane Ball

Cleveland plating company, Mr. Ball designed and supervised construction of plating fixtures and developed plating methods and procedures. He also performed considerable experimental work on metals.

Pantex Names New Representative

Appointment of *Henry Herman* as sales representative for the "Speedy-electric" line of equipment for the Dupont steamspray process, has been announced by *Pantex Mfg. Corp.*, Pawtucket, R. I.

Formerly associated with the Nordson Corp. of Amherst, Ohio, Mr. Herman has had considerable experience in industrial finishes engineering.

He will serve a territory that covers northern New Jersey and eastern New York including Albany and Schenectady counties.

Narda Ultrasonics Expands Field Staff

Narda Ultrasonics Corp., Westbury, N. Y., has announced the opening of New York State and midwest regional factory sales and service offices.

Herbert A. Frankel of New York City has been appointed New York State regional sales manager, and *Marvin Klein* has been named midwest regional sales manager to head the company's branch office at 5785 No. Lincoln Ave., Chicago, which will service the Great Lakes area.

Mr. Frankel, a graduate of Massachusetts Institute of Technology and member of the American Institute of Mechanical Engineers, was formerly with General Ultrasonics Corp. and has long been active as a manufacturer's representative in the chemical processing and metal finishing industry. His headquarters will remain at the plant in Westbury.

Mr. Klein, formerly a distributor of the firm's products, will coordinate engineering, sales and service at the new Chicago office and warehouse.

Rice Joins Lancy Laboratories

Lancy Laboratories, metal finishing and waste treatment consultants, announces the association of *Robert L. Rice, P.E.*, as vice president in charge of the Philadelphia office. The research and development laboratory is located with the Pittsburgh office at Zelienople, Pa., under the direction of Dr.



Robert L. Rice

L. E. Lancy, president. Mr. Rice was director and vice president of Fischer & Porter Co., Hatboro, Penna., manufacturers of chlorinators, chemical feeders, and a complete line of process instrumentation.

Ceilcote Appoints Division Sales Manager

Ceilcote Co. has announced the expansion of its national sales organization and appointed two men to fill the newly-created posts of division sales managers.

Tapped for the position of eastern sales manager was *John G. Galloway*, a native of Cleveland, Ohio, and a member of the sales organization for three years. In addition to his new sales supervisory duties, Galloway will head the company's eastern office in Princeton, N. J., and assume responsibility for the operation of warehouses in that territory. As army veteran and gradu-



T. D. Skaggs



John G. Galloway

ate of Ohio State University, Galloway is an active member of the National Association of Corrosion Engineers.

T. D. Skaggs was promoted to the position of southeastern sales manager with headquarters in Birmingham, Ala. In his new position Mr. Skaggs will be responsible for directing the activities of all salesmen and warehouse operations in his territory. Skaggs joined the firm four years ago after extensive experience as a process design engineer with the Ethyl Corp. and General Chem. Corp. A combat pilot with the Ninth Air Force in Europe during World War II, Skaggs is active in many social and professional organizations in Birmingham.

Henderson Named as Asst. Distributor Sales Manager With International Rectifier

The appointment of *Ronald Henderson* to the position of assistant sales



Ronald Henderson

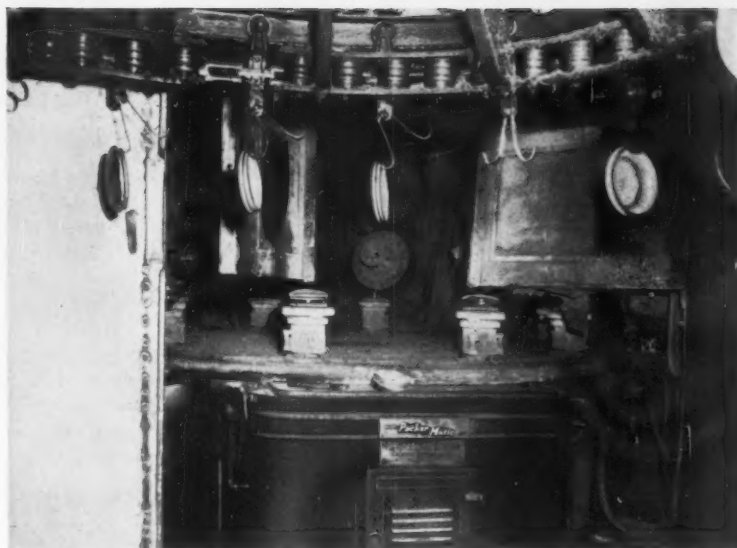
manager, Distributor Division, has been announced by *International Rectifier Corp.*, El Segundo, Calif.

Formerly a field sales engineer with the firm, Henderson is a graduate of the University of California. He was a components sales engineer in the Los Angeles area before coming with the company.

Davis is Promoted by Michigan Abrasive

Kenneth C. Davis has been named assistant general manager of *Michigan Abrasive Co.*

After World War II army service, and sales and advertising experience with several companies, Mr. Davis joined the company in 1950 as a sales representative. His work soon brought



24 million pot lids can't be wrong!

Ask your wife. She will tell you about famous Revere Ware. Probably best known by their copper bottoms, the durable luster of pots and pans by Revere is taken for granted.

"Taken for granted" is exactly the phrase applied to the 3 Packer-Matic polishing and buffing units in Revere's Rome, N. Y. plant by Mr. F. W. Merry, Assistant Works Manager. "We feed them and our Packer-Matics do the rest," says Mr. Merry. "They haven't failed us in 23 years of high production rate operation." "They get a good clean up twice a year and that's about the extent of our maintenance."

Achieving highly reflective finishes on pot lids is only one of hundreds of polishing, deburring, buffing and cleaning applications Packer-Matics have handled since Mr. Clifford I. Packer turned out his first unit in 1927. Chances are we can help you in your finishing operations, too. Send us samples with your specifications or blueprints and see.

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an advancement as district sales manager for Michigan and Ontario.

Mr. Davis is a member of the American Society of Abrasives.

Acoustica Acquires Universal Dynamics

Acoustica Associates, Inc., has acquired the *Universal Dynamics Corp.*, Santa Barbara, Calif., manufacturers of piezoelectric ceramics used in ultrasonic and sonar equipment. The purchase was made through an exchange of shares of Acoustica stock.

Universal Dynamics will operate as a wholly owned subsidiary of Acoustica. *Harry W. Kompanek*, who formed Universal a year ago, will continue as president of the subsidiary.

Governor Meyner Dedicates New Research and Development Lab. for Engelhard Industries, Inc.

On June 5 Governor *Robert B. Meyner* dedicated a new million-dollar research and development laboratory in Newark, N. J. for *Engelhard Industries, Inc.*, world's largest precious metals refiners and fabricator.

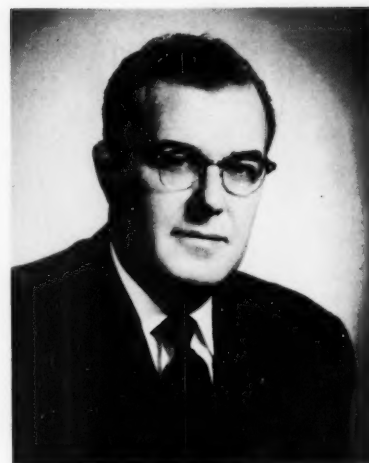
The laboratory houses most of the Research and Development Division, one of 15 divisions, and is divided into the Physics Department and the Chemical Department. Two sections of the latter department, specializing in instrumental analysis and electrochemistry, remain at the firm's headquarters building, 113 Astor St., Newark, where the entire laboratory formerly was located. The library, one of the most complete chemical and metallurgical reference centers in the nation, is in the new building.

Eighty scientists and technicians work in the new laboratory. A staff of 20 remains in the Astor St. laboratory. The new building contains 37,000 sq. ft. of floor space, 30,000 of it occupied by the laboratory. It is on a site near the New Jersey Turnpike and commands a view of the New York skyline.

Promotions Announced by Enthone, Inc.

C. C. Helmle has been appointed vice-president and general manager of *Enthone, Inc.* of New Haven, Conn., a subsidiary of American Smelting and Refining Co. He was previously vice-president and sales manager and will continue as sales manager in addition to his new duties.

Mr. Helmle has been prominent in



C. C. Helmle

the metal finishing industry for many years. After receiving a degree in chemical engineering from Rensselaer Polytechnic Institute, Troy, N. Y., he served for ten years as a plating chemist and metallurgist at the General Electric Co. plant in Bridgeport, Conn. In 1943 he was named a vice-president of Enthone and has played an active role in the rapid growth of the firm. He has published many articles on the engineering aspects of metal finishing. In the American Electroplaters' Society, he is a past president of the Bridgeport Branch and a past national officer. He is presently a member of the board of trustees of the Metal Finishing Suppliers' Association and chairman of their Trade Promotion Committee.

Also announced were the promotion of *Dr. Edward B. Saubestre* to technical director and *William K. Murray* to manager of marketing. Dr. Saubestre is a graduate of Columbia University and was associated with the Research



Edward B. Saubestre



William K. Murray

Laboratories Division of Sylvania Electric Products, Inc., Bayside, N. Y., before joining Enthone in October, 1953, as assistant to the research director.

Mr. Murray joined the firm in 1953 and was supervisor of the technical service laboratory for several years before becoming manager of customer service in 1957. He is a graduate of Rensselaer Polytechnic Institute and was previously employed by Wallace Silversmiths of Wallingford, Conn.

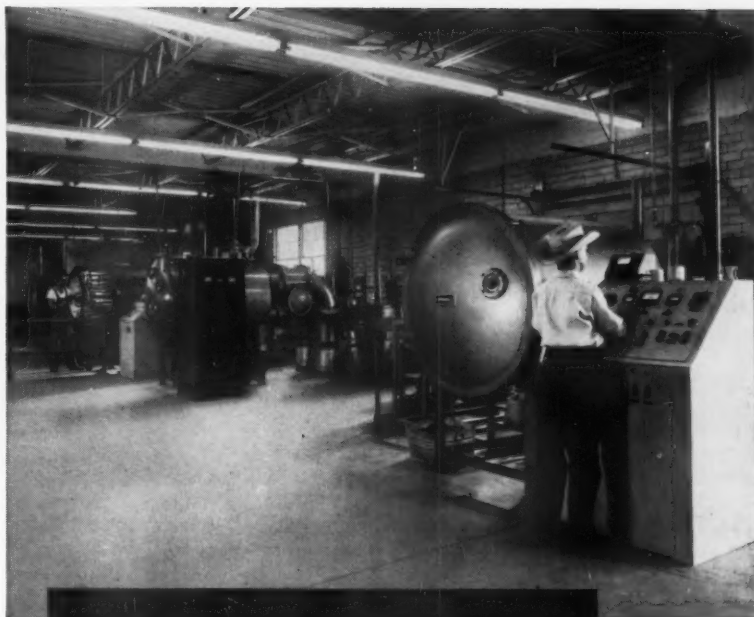
New Consulting Service

T. A. Leonhardt has started his own consulting and service engineering firm, located at 43 Tyler Ave., Webster Groves 19, Mo., telephone WO 2-6342.

Formerly with the Chandeysson Electric Co., he has thirty-six years of practical experience in motors and generators and is thoroughly capable in coping with all situations in the low voltage power conversion field.



T. A. Leonhardt



at Nichols Industries, Inc.

Stokes Vacuum Metallizers help toy maker capture new markets

Aluminizing metal parts of toy pistols and rifles has paid off handsomely for Nichols Industries, Inc., Jacksonville, Texas. Now one of the world's largest toy gun manufacturers, Nichols credits its four 48-inch Stokes Vacuum Metallizers with a big assist in speeding production and cutting costs, enabling the company to introduce new low-price items and become a leader in this competitive market.

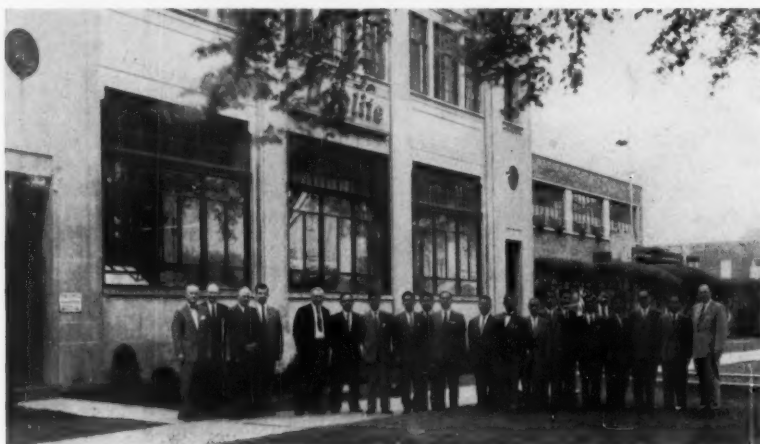
Nichols operates its Stokes metallizers around the clock, aluminizing zinc castings one to twenty inches in length. Vacuum metallized parts have a more brilliant finish than the previously electroplated items, and production time and labor are far less. The dependability, ease of operation and low maintenance of the Stokes units help keep costs low.

Vacuum metallizing offers attractive opportunities for many products made from many materials . . . including metal, plastic, glass, paper and textiles. And Stokes design and operating features assure you the full benefits of the process. Stokes offers valuable aid in planning your vacuum metallizing facilities . . . selecting the correct equipment . . . training operators. Contact your nearest Stokes office for a discussion of your requirements, or write for data on Stokes Vacuum Metallizers.

Vacuum Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Phila. 20, Pa.

STOKES

Japanese Team Visits Udylite Corp.



The Japanese Electroplating Study Team under the auspices of the International Cooperation Administration of Washington, visited the plants of *The Udylite Corp.* recently. This team consisted of twelve Japanese heads of electroplating shops or manufacturing firms doing electroplating in Japan. As these team members did not speak or understand English they were ac-

companied by two interpreters and the program planner, *Bill J. Zouras* of John A. Patton Management Engineers, Inc., of Chicago.

Frederick Gumm Chemical Co. Appoints Distributor

Frederick Gumm Chem. Co. announces the appointment of the *Chemical Services, Inc.*, 1216 Zonolite Road,

N.E., Atlanta 6, Ga., as distributor of its complete line of products in the State of Georgia. Sales will be under the direction of *Richard M. Jones*, vice-president.

H-VW-M Appoints Australian Representative

Glen Walker & Co. Pty. Ltd. have been appointed the sole Australian agents for *Hanson-Van Winkle-Mun-ning Co.* They have started Australian production of addition agents under the names of Nickel-Lume, Levelume, and H-VW-M Bright Cyanide Copper.

All H-VW-M products will carry free laboratory and technical service throughout Australia.

Free Course in Electroplating

The course of study in electroplating given at the Fort Greene Evening High School, 29 Fort Greene Place, Brooklyn, N. Y. (formerly Brooklyn Evening Technical High School) will begin its Fall term on September 16, 1959.

The session is divided into classroom discussion and laboratory experiments. The classroom topics will include simple calculation, reading



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graphs, chemistry of the plating tank, pH, wetting agents, pitting, deionizing. The laboratory experiments will include solution analysis, Hull cell studies, anodizing.

Registration begins September 14, 1959, and daily thereafter from 7:00 to 8:30 P.M. Classes will meet on Monday and Wednesday from 6:45 to 8:15 P.M. including about 6 Fridays. The term begins September 16 and ends January 31, 1960. Register with Mr. L. Serota in Rooms BW17 or 3E12.

Manufacturers' Literature

Dialysis Separation

Graver Water Conditioning Co., Dept. MF, 216 W. 14th St., New York 11, N. Y.

A comprehensive article on the theoretical and practical aspects of dialysis, Technical Reprint T-174 covers the basic equations involved in dialysis separation; the type and design of dia-

lysis membranes and equipment, and industrial applications possible with the Hi-Sep dialyzer.

Viscosity Control

Graymills Corp., Dept. MF, 3705 N. Lincoln Ave., Chicago 13, Ill.

An eight page, illustrated brochure is available from the above firm on its Visgard automatic viscosity control system for varnish, paint, and other coating materials. Such information as construction features, operation and installation is detailed in the booklet.

Barrel Finishing

Roto-Finish Co., Dept. MF, Kalamazoo, Mich.

A new 30-page catalog on precision mechanical finishing and automatic processes outlines in detail the various types and includes illustrations and detailed descriptions of the various conventional models as well as the Roto-Matic automatic finishing machine, and the Vibrator which employs a vibratory abrasive action. Dimensions, capacities, and recommended usage of the various types of equipment are also included.

Wetting Agents

Antara Chem. Div., General Aniline & Film Corp., Dept. MF, 435 Hudson St., New York 14, N. Y.

The Emulphogene BC family of non-ionic surfactants are described and their properties discussed in a new booklet.

Protective Coatings

Lining Engineering Corp., Dept. MF, 5000 W. Lake St., Melrose Park, Ill.

A looseleaf brochure contains a full description of the various pail and drum coatings in the LEC line, including specifications, application data, baking instructions and related data.

Barrel Finishing

Tumb-L-Matic, Inc., Dept. MF, 10 St. Mary's St., Stamford, Conn.

A new data file, containing complete information on the company's line of tumbling barrels and compounds, consists of a heavy cardboard cover and 14 loose, single-page insert sheets each devoted to a particular type of barrel unit, tumbling medium, or finishing process.

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Tank Linings

Buckley Iron Works, Inc., Dept. MF, 21 Christopher St., Boston 22, Mass.

The complete tank and corrosion resistant tank lining services of the above firm are listed in a four page brochure. Illustrated, among others, are a lined filter, tank, blower, hood and sink.

Vacuum Metalizing

Bee Chem. Co., Logo Div., Dept. MF, 12933 So. Stony Island Ave., Chicago 33, Ill.

A new 18-page booklet on vacuum metalizing spray coatings includes base coats for use before metalizing as well as top coats and back up coats for use after metalizing, along with other helpful information on the metalizing operation.

Ultrasonic Cleaning Equipment

National Ultrasonic Corp., Dept. MF, 111 Montgomery Ave., Irvington 11, N. J.

A four page, illustrated booklet describes how ultrasonic cleaning works, and gives specifications and features of both standard and heavy duty units.

Plate-Coil Work Sheets

Dean Thermo-Panel Coil Div., Dean Prod. Inc., Dept. MF, 616 Franklin Ave., Brooklyn 38, N. Y.

Data Sheet No. 58 relates entirely to fitting arrangements for single embossed panels, a total of 40 variations. Data Sheet No. 59 takes care of fitting arrangements for double embossed panels, a total of 22 variations.

In addition the sheets contain drawings and dimensions for threaded or welded elbows, couplings, and male and female threaded fittings. Inlet and outlet sizes are given as well as fitting lengths. And one of the sketches shows the new Slip-Over fitting which assures greater heating or cooling capacity.

Barrel Finishing

Metal Parts Sales Co., Dept. MF, 165 Delancy St., Newark 5, N. J.

The above firm has available a listing of its various models of barrel finishing machines, special finishing machines, handling and miscellaneous equipment.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Dayton Branch

The May meeting was held as a dinner meeting at the Yum Yum Restaurant on May 20. During the business sessions the delegates were instructed to oppose any dues increase exceeding \$2.00. They were also instructed to oppose changing the due date for per capita tax to September 1, as it was felt that this does not allow ample time for the members to make payment.

W. C. Jenkin was welcomed as a new member. After a report from *Herman Austen*, chairman of the nominating committee, the following were elected to office for the coming year: *Bennie Cohen*, president; *Byron Bowman*, 1st vice president; *Larry Hadlock*, 2nd vice president; *Richard Wright*, librarian; *Richard Clinehens*, secretary; *Duane Prosser*, treasurer. *Jack Baker*, retiring president, auto-

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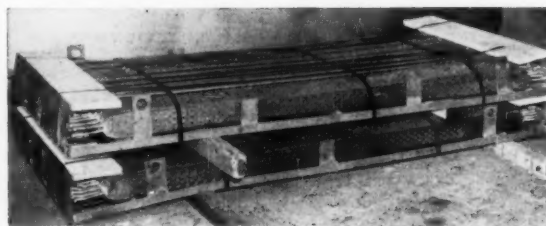
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Manufacturers of Welded Fabrications to Specification

matically became a member of the board of managers.

Dr. Emery P. Miller, Ransburg Electrocoating Corp., of Indianapolis, Ind., gave an excellent explanation, accompanied by colored movies, of electrostatic spray painting.

L. A. Critchfield,
Publicity Chairman

Blue Ridge Branch

The branch held its regular monthly meeting on May 1 at the Elks Club at 6:30 P.M.

P. D. Callahan, member and librarian, gave a short introduction of the Roanoke G. E. plant describing the controls manufactured there. The group was led to the plant near Salem and was conducted through all phases of the finishing plant. Among the highlights were the automatic plating installations, automatic organic coating systems, use of plastisols, barrel finishing, high speed spot plating and zinc coating of castings.

It was announced that at the next meeting at Winston-Salem, June 5, regular election of new officers would be conducted. The program scheduled was to be a tour of Bossick-Sack plant un-

der the direction of *Bruce Wallace*.

Carl A. Witherspoon, Jr.,
Secretary-Treasurer.

British Columbia Branch

The May general meeting took the form of a plant tour through the brand new factory of Western Copper Mills Ltd. in New Westminster.

Groups of approximately a dozen people were led on the tour by representatives of the company. The tour covered the complete cycle of manufacture, from the raw copper in electrolytic sheet form, through the casting process, on to where the billets were extruded and finally to the subsequent drawing operations where the material was formed into the required sizes of tubing. Following the tour through the manufacturing section of the plant we were shown through the very impressive and up-to-date laboratory facilities and finally we visited the hard chrome plating shop, where the drawing dies are hard chrome plated.

The massive and modern machinery in the plant aroused a great deal of interest among those attending and the evening was brought to a close in the

plant cafeteria with coffee and sandwiches, generously provided by the company.

There was no business conducted at this meeting, which adjourned at 10:00 P.M.

N. A. Shepherd,
Secretary

Baltimore-Washington Branch

The regular monthly meeting was held Tuesday evening, May 12, at the Regent House Hotel, Baltimore, Md.

The speaker for the evening was *James C. Withers*, Melpar Corporation, Falls Church, Va. Mr. Withers spoke on "Better Nickel Plating" including the use of periodic reverse current in plating from non-aqueous mediums. Mr. Withers also spoke of superimposing a.c. current on d.c. current in the chloride and the Watts types baths and the effects of these on the properties of the deposit. The talk was illustrated with numerous slides.

The main business of the evening was the election of officers for the coming year. The following were elected: president, *Edward E. Oberland*; vice-

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"THE FOUR McALEERS"

president, *Harold W. Scott*; secretary, *Edward J. Roach*; treasurer, *Lancaster Lowry*; librarian, *Joseph Eisenberg*.

Russell M. Munson, *Richard G. Black* and *John Megargell* were elected to membership.

Harold W. Scott,
Secretary

Los Angeles Branch

Revisions in the branch by-laws as proposed by a committee headed by past-president *Norman McEwan*, were discussed and most suggestions approved at the branch's May 13 meeting in Rodger Young Auditorium.

The committee made suggestions for minor changes, most of which are intended to tighten the by-laws, bring them up-to-date, and delete sections which have become obsolete or unnecessary.

Sergeant-at-arms *Clair Verwest* introduced the following guests:

Mr. and Mrs. *William N. Cope*, Lockheed Missile System; Mr. and Mrs. *Francis T. Eddy*, Bayside Industries, Inc., Costa Mesa; *Leroy Hunter*, Carlson Rules, Inc., Los Angeles;

Charles Schoneman, Rohr Aircraft, Riverdale; *Kenneth LeDuc*, Lockheed Aircraft, Burbank; *Norman Amdur*, Lockheed Aircraft; *Kenneth Mays*, James H. Rhodes, Inc.; and *Jack Quintana*, Pacific Scientific, Anaheim.

For the educational session, Librarian *Marjorie Farmer* had arranged a panel discussion on phosphate coatings. The panelists were *Claude Weekly* and *Ben Gast*. A question-and-answer period, moderated by Miss Farmer, followed.

St. Louis Branch

The regular monthly dinner meeting was held at the York Hotel, Wednesday, May 13 with 17 people present for dinner and 31 present when the business meeting was called to order by President *William George*. Three new members were elected on a motion that passed without opposition, and *Andy Julius* reported on the Mid-West Regional meeting which he attended at Milwaukee.

The chairman of the educational committee was ill and unable to attend the meeting so *Louis Berra* reported

for the school. The school received a Federal grant of \$250 because it was among the top classes and the money will be used to buy a pH meter. *Dr. Otto Klein*, the instructor, was present to present the diplomas. The following students were present: *Louis J. Berra*, *William George*, *John Cassani*, *Maurice V. Devitt*, *William Piel*, *James O. Harriman*, *Louis W. Voelker*, *Charles E. Sweeney* and *Melvin C. Elder*. A special hand was given Otto for his excellent job.

It was gratifying to hear that *Craig McAlister*, past president of the branch, would serve on the educational committee for the 1962 Milwaukee convention. *Andy Julius*, another past president and presently a delegate from the branch, was notified he would serve on the honorary membership committee.

L. A. Davies was called upon to install the officers for the coming year. *William Piel* was installed as president. *George Koderhandt*, 1st vice president, and *Homer Thomen*, 2nd vice president, were absent. *Ward Kelly* and Mr. Berra retained their offices, secretary

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and treasurer, respectively. *Richard Gotsch* was installed as librarian and *Pete Young* as sgt. at arms.

William Piel took over the meeting at this point and asked Dr. Klein to say a few words. The meeting was then turned over to Mr. Gotsch, who introduced the speaker of the evening, *Craig McAlister* of Bussmann Mfg. Co., who talked on bright alloy barrel plating. *Clarence Mange*, a prominent consultant in St. Louis, was on hand to lend his knowledge to the discussion. A very active question and answer period followed the talk. A rising vote of thanks was given Craig for his excellent presentation. The meeting was adjourned at 10:10.

Ward Kelly,
Secretary

Newark Branch

Some seventy-five members attended the May 15th meeting. President Meyer announced that the Metropolitan Regional meeting with New York was scheduled for September 1959 at New York. The branch voted in favor of this joint meeting. *Edward G. Doyle* of Frequency Standards was elected a

member. The matter of an increase in dues was brought up and discussed at some length, with Messrs. Wesley and Nichols pointing out the need for an increase. *John Banta* presented the motion approved by the executive committee that the delegates be instructed to vote for no more than a \$2.00 per year increase. *Don Foulke* asked that the motion be modified to the extent that "the branch favors an increase in per capita tax at this time not in excess of \$2.00/year and that the delegates are to go uninstructed but aware of the branch feeling." This was passed. It was also moved and passed that delegates and alternates to the Convention be paid up to \$100 for expenses unreimbursed by their companies. Dr. Foulke was then introduced by Mr. Banta, librarian for the evening, and discussed advances in nickel plating with particular emphasis on duplex coatings. The talk was kept brief because of the long business meeting and the fact that the speaker was on crutches as the result of an infected foot. Dr. *Burt Knapp* then gave the principal talk of the evening on Gases in Electrodeposits. Dr. Knapp explain-

ed how gases could be determined and discussed the problem of hydrogen in bright nickel. The talk concluded with a discussion of Edwards' recent paper which showed the H, C and O increase in bright nickel deposits with increased bath use. The lateness of the hour resulted in a limited question-and-answer period for this interesting paper.

D. G. Foulke

Waterbury Branch

The branch had its final meeting of the season at the Hotel Elton on May 14. The first major item of business was the installation of the incoming officers. *Bill Coleman* did a fine job as installer. The officers elected and installed were as follows:

President—*Frank Tirendi*; 1st Vice-President—*William C. Giesker*; 2nd Vice-President — *Louis Porretti*; Librarian—*P. R. Mazzamano*; Assistant Librarian—*S. L. Doughty, Jr.*; Publicity — *Francis A. Schneiders*; Research Chairman—*Raymond L. Mitchell*; Secretary-Treasurer—*James R. Kennedy*; Board of Managers—*Edward J. Garland, Spencer L. Henn, Theodore Voyda*.

The second feature of the evening

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was an Old Timers program. Waterbury Branch which, to the best of our knowledge, was the sixth in the nation, dates back to 1921 when it had 22 charter members. Of the original members eight are still active and four attended the meeting. Secretary *Al Griffith* read from the minutes of the meetings of the early years and, assisted by a panel of charter members, developed the early history of the branch. The charter members present were *William Coleman*, *William Gray*, *Joseph McConas* and *Joseph Muscio*.

Francis A. Schneiders,
Publicity

Chicago Branch

The branch met for the regular monthly meeting on Friday, May 1, at the Western Society of Engineers. *Matt Dassinger* conducted the business meeting. An increase in dues being imperative in order to satisfy the needs of the National Society, a very lively discussion followed in regard as to the amount required to help out the Society. It was decided to let the delegates use their own judgment at the Detroit meeting in June regarding the amount of increase in dues for the branch. There were three guests from Japan, members of their electroplaters society, who also attended the meeting.

Simon P. Gary, librarian, introduced the speaker of the evening, *Dr. Harold J. Wiesner* of the Bendix Corp. His subject, the "Hard-Coat Anodizing of

Aircraft Components" was illustrated with slides. Following a question and answer period and a round of applause for *Dr. Wiesner*, the meeting was adjourned.

Christopher Marzana,
Publicity Chairman

Novelli Honored by M.E.P.A.



(Left to right) *Mariano Ranno*, Masters' Electroplaters President, *Al Marinaro*, Secretary of the Masters' Electro-Plating Association of New York, *Sylvestro Novelli*, and *Frank Kaiser*, Treasurer.

At the Masters' Electro-Plating Association annual banquet, a gala affair held at the Plaza Hotel in New York, *Sylvestro Novelli* was honored as the Plating Man of the Year. Mr. Novelli is the owner of the *Service Plating Company*, Brooklyn, New York.

FEDERATION OF PAINT AND VARNISH PRODUCTION CLUBS

With more than 90% of the available exhibit area already reserved and applications for space still coming in, the Paint Industries' Show of 1959, to be held in Atlantic City from October 20 to 24, is an assured success.

Members of the Federation of Paint and Varnish Production Clubs and visitors to the show will have an opportunity to see the latest developments in equipment and materials, and to discuss their problems with outstanding technologists and engineers associated with the above firms.

The exhibitors this year will get a bonus of extra exhibit time and a larger audience because the show will be opened to members of the National Paint, Varnish and Lacquer Association whose convention will be held in Atlantic City from October 19 to 20. The show, which will be held in the lower level of Convention Hall, will be opened to the executives of the paint industry on October 20 from 4-7 p.m. and on October 21 from 2-6 P.M.


The official opening of the Show for members of the Federation will be on October 22 at 9 A.M. It will close on Saturday, October 24.

NEW BOOKS

Handbook of Practical Electroplating

By *Thomas M. Rodgers*. Published by *The Macmillan Co.*, 60 Fifth Ave., New York 11, N. Y. 1959. 333 pages. Price: \$8.50.

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Metal Industry Handbook & Directory

Published by Iliffe & Sons Ltd., Dorset House, Stamford St., London S.E. 1, England. 1959 Price: 21s. 566 pages.

The 48th edition of this annual handbook-directory is slightly larger than the last edition, although the section on electroplating and allied processes has remained about the same. The handbook is issued free of charge to subscribers of the weekly journal *Metal Industry*, who comprise those engaged in the non-ferrous metal industries. For the field it serves, the handbook is still one of the most comprehensive sources of quick information, and the amount of information on finishing is adequate. A very complete directory for buyers is always one of the features of the volume, but will be of more interest to British than to American readers.

News from California

By Fred A. Herr



One of the little sidewalk cafes in Paris, France, on June 4 was to be the meeting place of two women members of Los Angeles Branch, A.E.S. Mrs. Vonna Ott, who operates a plating shop in Pasadena, Calif., and her husband, Dr. Lawrence H. Ott, a physicist with Hughes Aircraft Co., Culver City, Calif., left Los Angeles on May 16 for a trip to Europe which was to include visits to England, France, Germany, Switzerland and Italy. Miss Marjorie Farmer, a research engineer at North American Aviation, El Segundo, Calif., who is librarian of Los Angeles Branch, left May 28 for a trip through Europe and the Middle East.

They agreed to meet at a certain cafe

in the Rue de la Paix in Paris on Thursday, June 4, to drink a toast to Southern California.

That could be quite a reunion of Californians in Paris if chance should cause the paths of several other Los Angeles people to cross that of Miss Farmer and the Otts. Mr. and Mrs. Don Bedwell were also in Europe in June, making a leisurely tour of the countries on the mainland and the British Isles. Paul Franke and Mrs. Franke (he was plating superintendent of Price-Pfister Co., Los Angeles, for 35 years until his recent retirement), left Los Angeles in mid-May for a visit to Paul's homeland in Germany.

A new line for processing aluminum electronic parts has been installed in the Culver City, Calif., plant of Hughes Aircraft Co. The new line, which has been installed in the plant's main plating department, includes etching, nitric acid, cleaning, and chromating tanks, all 4 ft. x 4 ft. x 5 ft. in dimension. Some are steel, some of fiberglass.

Larry Henderson has been named

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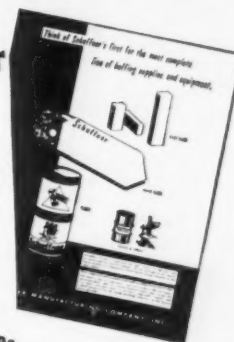
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head of the metal finishing department of the Mefford Chemical Co., Los Angeles, a branch of McKesson & Robbins, Inc. Henderson was active as a sales engineer on the Mefford staff before his recent promotion to department head.

Kenneth D. Mays has been named district representative in the eleven western states for James H. Rhodes & Co. of Chicago, manufacturers of cut felt, felt wheels, chamois skins, pumice stone, buffs and abrasives. Mays was formerly a sales engineer for Disston Saws Co. of Los Angeles.

Edward Delamanti, formerly with Anadite, Inc., South Gate, Calif., recently joined the Manco Plating Co. of Los Angeles, as supervisor of the plating department.

Bowman Chemicals, 4606 Long Beach Ave., Los Angeles, reports the appointment of *Victor R. Genco*, who has served as company manager for the past year, to the post of vice-president. Genco will also continue as manager. The firm is a pioneer in black

oxide finishes in Southern California.

A talk on "Pigmented Epoxy Coatings," by *Richard Fortner*, manager, technical services laboratory, Jones-Dabney Co., Los Angeles, highlighted the educational program of the last monthly meeting of the Los Angeles Paint & Varnish Production Club.

Mr. Fortner discussed epoxy catalysts in their various classifications and their pot life which, he said, is a definite consideration in epoxy catalyzed formulations.

The club's educational committee chairman, *Edward Campbell*, reported that *Everett Wood*, a Los Angeles high school teacher, had been chosen to represent the Southern California area at a paint course being held at the Missouri School of Mines, with expenses defrayed by the club.

Leo J. "Jack" Quintana has joined the staff of the Pacific Scientific Aero-products Co. in Anaheim, Calif., as chief electrochemist. In this capacity he will direct the company's new plating and finishing department which is engaged in electroplating and electro-

forming precision slip-ring assemblies with silver, gold, rhodium and palladium. The shop is also equipped to specialize in all types of precision plating.

Quintana was formerly on the staff of the electrochemistry section of Los Alamos Scientific Laboratory, Los Alamos, N. M. He graduated in chemistry from St. Michael's College, Santa Fe, N. M., in 1952, and has done graduate work at the University of New Mexico. He is a member-at-large of the A.E.S. but, with his removal to Southern California, is expected to join Los Angeles Branch in the near future.

Metallurgical Consultants, Maywood, Calif., have announced perfection of a new plating process, called Pyro-Plate, which is accomplished by heat treating.

According to *John J. Lawless, Jr.*, vice president, the process was invented by *Hoyt T. Todd*, a Whittier, Calif., metallurgical engineer. In effect, it reduces plating operations to their barest essentials and transforms a thin layer of deposit into an integrated part of the basis metal.

The process is described as involving the application of a paint-like or paste-like facing material to the metal. The materials are described as compounds composed of nickel or cobalt alloys. Application may be made in a desired way—brush, spray gun, spatula, flame spray or immersion, without surface preparation or masking. The part then is heat treated in special atmospheres.

Ground was broken in May for a million dollar plant in Hawthorne, Calif. for the Filon Plastics Corp. of El Segundo, Calif. The new facility will occupy a nine acre site and will be equipped exclusively for production of fiberglass-reinforced plastic. The 72,000 sq. ft. plant is said to be the largest in the world devoted only to plastic production. Completion is expected by mid-December.

Challenger Lock Co. moved in mid-May from West Los Angeles, Calif., to a new manufacturing and finishing plant at 2349 La Palma Ave., Anaheim, Calif. The firm's major production centers on locksets for residential, commercial, and institutional use, for the finishing of which an extensive finishing and polishing department has been included among the new facilities in Anaheim.



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300—Assorted size wood, steel, rubber, plastic, lead lined and stainless tanks up to 30 ft. long.

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5—Industrial Filters, RDR-2, 36 x 3630, for nickel, complete.

100—Various sizes rectifiers from 25 amp. to 5000 amps. Selenium, Germanium, all complete with controls.

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- 8—Henderson barrels 5A tilting type.
- 4—Globe barrels.

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- 2—Production Machine #484-2.
- 5—Acme A2.
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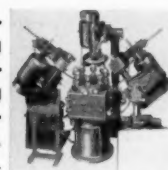


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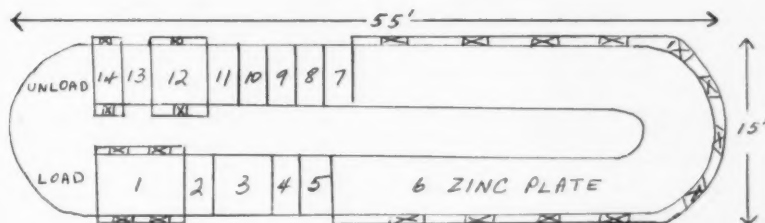
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Adaptable to Zinc, Nickel, Phosphate or
 Anodize Cycle



No.	Process	Time	Transfer time — 30 sec
1	Anodic clean	2 min	Immersion time — 20 sec
2	Cold rinse	20 sec	Height of lift — 50"
3	Acid dip	70 sec	Carrier centers — 24"
4	Cold rinse	20 sec	Total carriers — 46
5	Cyanide rinse	20 sec	Rack width — 17"
6	Zinc plate	19.5 min	Work length — 40"
7	Reclaim rinse	20 sec	Length & Width — 55' x 15'
8&9	Cold rinse	20 sec	Height — 12' 8"
10	Acid dip	20 sec	All tanks are 44" wide, 54" deep x 1/4" thick.
11	Cold rinse	20 sec	Exhaust system, heating coils, temp. controls, bus bars & all equipment to make a complete plater.
12	Chromate	20 sec	
13	Cold rinse	20 sec	
14	Hot rinse	20 sec	
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500	60	Westinghouse
698	47.5	Elec. Prod.
750 (Twin)	6	H-V-W
750/375	6/12	Excell-All
845	47.3	Elec. Prod.
940	32	Elec. Prod.
1000/500	6/12	Chandeysson
1500/750	6/12	G. E.
1500	15	Star
1500	30/50	Century
1500	40/65	G. E.
1500	65	Westinghouse
1500	70	Century
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5000/2500	6/12	Columbia
5000/2500	9/18	Chandeysson
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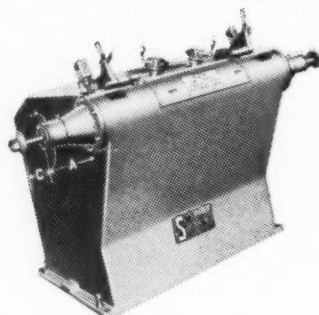
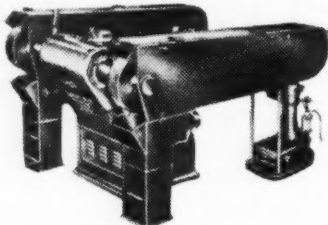
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- * **TEMPEREX** — Produces pure 24K Gold electroplate which will withstand higher temperatures than any pure Gold plate known.
- * **THERMOKARAT**—Produces exceedingly hard (470 Vickers) 18K Gold electroplate for decorative or industrial applications.
- * **RHODEX**—a patented Rhodium plating process which yields compressively stressed, crack-free deposits, permitting thicker Rhodium electroplate than ever before possible.

PLATANEX L/S—low stress Platinum plating process produces essentially nonporous electroplate for high temperature and other exacting industrial applications—no intermediate scratch brushing or burnishing required.

- * **KARATCLAD GOLD PROCESSES**—acid Gold processes for decorative applications—Jeweler's Finish in any thickness, in a wide range of non-varying colors.

BRIGHT RHODIUM PROCESS—yields brilliant, fine grained, non-tarnishing deposits. Manufactured in our own air conditioned laboratories, its purity assures consistent quality results for all decorative applications.

- * **SILVREX BRIGHT SILVER**—mirror-bright deposits in any thickness, operates at room temperature in current densities from 10 to 40 asf—hard and ductile deposits.

SILVER SOL-U-SALT—a water soluble double cyanide salt—permits new ease and facility in the preparation of Potassium Silver Cyanide plating solutions.

POTASSIUM GOLD CYANIDE—the purest available—used in the preparation of our own exclusive Gold Plating Processes—manufactured in moisture controlled facilities.

INDUSTRIAL SILVER PLATING PROCESSES—a complete line of silver plating formulations for high speed industrial applications.

*Patented and patents pending.



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Whenever he called on a customer, they followed right along. Seated beside a customer's desk, he answered most of the questions about his product and how it would work on the production line. But every once in a while he'd have to turn to the 44 men standing behind him . . . he'd have to check his information or find the right answers.

They were the men from the Analysis, Research or Customer Service Laboratories; they were other sales representatives relating their own experiences; they were product engineers and management men . . . all sharing their metal finishing knowledge with the MacDermid salesman.

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